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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N74-11804 Stanford Univ., Calif.
AERODYNAMIC SOUND GENERATION DUE TO VORTEX-AEROFOIL INTERACTION Ph.D. Thesis
Rangaswamy Parthasarathy 1973 150 p
Avail: Univ. Microfilms Order No. 73-14954

The aerodynamic sound produced by a vortex passing past an airfoil in uniform motion is studied. Following the procedure proposed by Lighthill to study how aerodynamic flows produce noise, the complete flow field is broadly divided into two separate regions: (1) a region of sound generation in the neighborhood of the airfoil, and (2) a uniform medium at rest where sound, due to the fluid fluctuations in the region (3) is being propagated. The vortex-airfoil interaction problem is formulated as a vortex of strength K being released ahead of an airfoil of chord C, at a specific location, at time t = 0. Classical two dimensional incompressible, inviscid, unsteady potential airfoil theory has been employed to determine the trajectory of the vortex, the forces acting on the airfoil, and the complete flow field around the airfoil. Dissert. Abstr.

N74-11805 Engineering Sciences Data Unit, London (England).
STABILITY DERIVATIVE. CONTRIBUTION OF FULL-SPAN DIHEDRAL TO ROLLING MOMENT DUE TO SIDESLIP
Apr. 1973 5 p
(ESDU-Aircraft-06.01.03-A-B) Copyright. Avail: Issuing Activity

A numerical method for determining the stability derivative associated with full span dihedral contribution to the rolling moment of an aircraft due to sideslip is presented. Mathematical models are developed for four values of the taper ratio for wings having constant dihedral over the entire wing semi-span. It was determined that the contribution of dihedral to the rolling moment due to sideslip varies linearly with dihedral angle and is independent of the lift coefficient provided the latter is below about sixty percent of its stalling value. Author

N74-11806*# Princeton Univ., N.J. Aeroelastic and Magnetoelastic Lab.
LARGE AMPLITUDE FLUTTER OF A LOW ASPECT RATIO PANEL AT LOW SUPERSONIC SPEEDS COMPARISON OF THEORY AND EXPERIMENT
C. S. Ventres and C. K. Kang Aug. 1973 85 p refs
(Contract NAS8-28577)
(NASA-CR-120105; AMS-1116) Avail: NTIS HC $6.25 CSCL 01A

Flutter boundaries, as well as flutter limit cycle amplitudes, frequencies and stresses were computed for a panel of length-width ratio 4.48 exposed to applied in-plane and transverse loads. The Mach number range was 1.1 to 1.4. The method used involved direct numerical integration of modal equations of motion derived from the nonlinear plate equations of von Karman, coupled with linearized potential flow aerodynamic theory. The flutter boundaries agreed reasonably well with experiment, except when the in-plane loading approached the buckling load. Structural damping had to be introduced, to produce frequencies comparable to the experimental values. Attempts to compute panel deflections or stress at a given point met with limited success. There is some evidence, however, that deflection and stress maxima can be estimated with somewhat greater accuracy. Author

N74-11807*# Boeing Co., Wichita, Kans.
ANALYSIS AND TESTING OF AEROELASTIC MODEL STABILITY AUGMENTATION SYSTEMS Final Report
Francis D. Sevart and S. M. Patel 15 Oct. 1973 167 p refs
Original contains color illustrations
(Contract NAS1-11833)
(NASA-CR-132345; D3-9245) Avail: NTIS HC $10.50 CSCL 01A

Testing and evaluation of a stability augmentation system for aircraft flight control were performed. The flutter suppression system and synthesis conducted on a scale model of a supersonic wing for a transport aircraft are discussed. Mechanization and testing of the leading and trailing edge surface actuation systems are described. The ride control system analyses for a 375,000 pound gross weight B-52E aircraft are presented. Analyses of the B-52E aircraft maneuver load control system are included. Author

N74-11808*# Boeing Commercial Airplane Co., Seattle, Wash.
THE RESULTS OF LOW-SPEED WIND TUNNEL TESTS TO INVESTIGATE THE EFFECTS OF THE NASA REFAN JT8D ENGINE NACELLES ON THE STABILITY AND CONTROL CHARACTERISTICS OF THE BOEING 727-200
M. D. Shirkey Oct. 1973 31 p
(Contracts NAS3-16815; NAS3-17842)
(NASA-CR-134503; BCAC-D6-41312) Avail: NTIS HC $3.75 CSCL 01A

The results from two low-speed wind tunnel tests of the Boeing 727-200 airplane as configured with the NASA refan JT8D-109 turbofan engines are presented. The objective of these tests was to determine the effects of the refan installation on the low-speed stability and control characteristics of the 727 airplane. Four side nacelle locations were tested to insure that aerodynamic interactions of the nacelles and empennage would be optimized. The optimum location was judged to be the same as that of the production JT8D-9 engines; the current production engine mounts can be used for this location. Some small changes in the basic airplane characteristics are attributable to the refan nacelles. The flaps up longitudinal and lateral-directional stability are both slightly increased for low angles of attack and sideslip respectively. The longitudinal stability at stall is improved for both the flaps up and landing flap configurations. The high attitude characteristics of the basic airplane are not significantly altered by the refan nacelle installation. Directional control capability is not affected by the refan nacelles. Author

N74-11809*# Boeing Co., Wichita, Kans.
ANALYSIS AND TESTING OF STABILITY AUGMENTATION SYSTEMS Final Report
F. D. Sevart, S. M. Patel, and W. J. Wattman 13 Jun. 1972 125 p refs
(Contract NAS1-10885)
(NASA-CR-132349; D3-8884) Avail: NTIS HC $8.25 CSCL 01C

Testing and evaluation of stability augmentation systems for aircraft flight control were conducted. The flutter suppression system analysis of a scale supersonic transport wing model is described. Mechanization of the flutter suppression system is reported. The ride control synthesis for the B-52 aeroelastic model is discussed. Model analyses were conducted using equations of motion generated from generalized mass and stiffness data.
Author

N74-11810*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
GEOMETRY PROGRAM FOR AERODYNAMIC LIFTING SURFACE THEORY
Richard T. Medan Sep. 1973 108 p refs
(NASA-TM-X-62309) Avail: NTIS HC $7.50 CSCL 01A

A computer program that provides the geometry and boundary conditions appropriate for an analysis of a lifting, thin wing with control surfaces in linearized, subsonic, steady flow is presented. The kernel function method lifting surface theory is applied. The data which is generated by the program is stored on disk files or tapes for later use by programs which calculate an influence matrix, plot the wing planform, and evaluate the loads on the wing. In addition to processing data for subsequent use in a lifting surface analysis, the program is useful for computing area and mean geometric chords of the wing and control surfaces.
Author

N74-11811*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
AN EXPERIMENTAL PROGRAM USING A 9.7 DEG HALF-ANGLE CONE MODEL AT FREE STREAM MACH NUMBER EQUALS 4.88 AND ALPHA PRIME S OF 10 DEG AND 29.5 DEG
H. Tom Faria Sep. 1973 16 p
(Contract NAS9-10976)
(NASA-CR-134132; Rept-73004) Avail: NTIS HC $3.00 CSCL 01A

The flow field of a blunted cone model at supersonic speeds is described. The data consist of surface pressure measurements, surface oil flow photographs, and schlieren photographs. The tests were conducted in a two-dimensional, blow down type wind tunnel, using air as a test gas. A mercury filled manometer board was used to measure model surface pressure data.
Author

N74-11812*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF SUBSONIC INLET LIP GEOMETRY ON PREDICTED SURFACE AND FLOW MACH NUMBER DISTRIBUTIONS
James A. Albers and Brent A. Miller Washington Dec. 1973 56 p refs
(NASA-TN-D-7446; E-7522) Avail: NTIS HC $3.00 CSCL 20D

The effect of subsonic inlet lip geometry on predicted surface and flow Mach number distributions is illustrated. The theoretical results were obtained from incompressible potential flow calculations corrected for compressibility. The major emphasis of this investigation is on the low-speed (takeoff and landing) operating conditions. The low-speed results were obtained for a range of three geometric variables of interest: contraction ratio, defined as the ratio of highlight area to throat area; internal lip major - to minor-axis ratio; and internal lip shape. The low-speed results were obtained at both static conditions and a free-stream velocity of 42.6m/sec, with incidence angles ranging from 0 deg to 50 deg. The results indicate that of the three geometric variables considered, contraction ratio had the largest effect on the surface Mach number distributions. The effects of inlet diameter ratio and blunting of the external forebody on maximum external surface Mach numbers are illustrated at a cruise Mach number of 0.8.
Author

N74-11813*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE TESTS ON AN EXTERNALLY BLOWN FLAP WITH THE ENGINE IN FRONT OF THE WING
Allen M. Karchmer and Robert Friedman Washington Dec. 1973 17 p refs
(NASA-TM-X-2942; E-7564) Avail: NTIS HC $2.75 CSCL 01A

Noise tests were conducted with a nozzle exhausting over a small scale model of an externally blown flap (EBF) lift-augmentation system, with exhaust impingement on the wing leading edge. Two series of tests were conducted: with wing leading edge inside the nozzle; and with leading edge set back from the nozzle exit plane 1 diameter on the jet axis. The results indicated no significant differences in spectral shape, level, or directivity pattern. Static lift and thrust tests were conducted on the same model indicated considerable flow attachment on both configurations, with slightly greater attachment and turning for the wing outside the nozzle. Finally, a comparison with engine-above- and engine-below-the-wing EBF's tested by previous investigators shows the acoustic performance of the configurations tested for this report to lie between the other two.
Author

N74-11814*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
RESULTS OF A FEASIBILITY STUDY USING THE NEWTON-RAPHSON DIGITAL COMPUTER PROGRAM TO IDENTIFY LIFTING BODY DERIVATIVES FROM FLIGHT DATA
Alex G. Sim Washington Oct. 1973 41 p refs
(NASA-TM-X-56017) Avail: NTIS HC $4.25 CSCL 01A

A brief study was made to assess the applicability of the Newton-Raphson digital computer program as a routine technique for extracting aerodynamic derivatives from flight tests of lifting body types of vehicles. Lateral-direction flight data from flight tests of the HL-10 lifting body reserch vehicle were utilized. The results in general, show the computer program to be a reliable and expedient means for extracting derivatives for this class of vehicles as a standard procedure. This result was true even when stability augmentation was used. As a result of the study, a credible set of HL-10 lateral-directional derivatives was obtained from flight data. These derivatives are compared with results from wind-tunnel tests.
Author

N74-11815*# Scientific Translation Service, Santa Barbara, Calif.
CALCULATION OF FLOWS AROUND ZERO THICKNESS WINGS WITH EVOLUTIVE VORTEX SHEETS
Colmar Rehbach Washington NASA Dec. 1973 25 p refs Transl. into ENGLISH from Rech. Aerosp. (France), No. 2, Mar. - Apr. 1972 p 53-61
(Contract NASw-2483)
(NASA-TT-F-15183) Avail: NTIS HC $3.25 CSCL 01A

The correct evaluation of the aerodynamic characteristics of some wing shapes requires the knowledge of the geometry of their vortex sheets. Out of the many calculations performed in this field, two are presented. The first one concerns a rectangular wing of very small aspect ratio (AR = 1), the second a sweptback wing of moderate aspect ratio (AR = 3.78). In both cases they are without thickness in incompressible flow. Their vortex sheets originate at the trailing edge and the wing tips.
Author

N74-11816*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPERIMENTAL INVESTIGATION OF A HIGHLY UNDEREXPANDED SONIC JET EJECTING FROM A FLAT PLATE INTO A SUBSONIC CROSSFLOW
Craig S. Shaw (Army Air Mobility Res. and Develop. Lab., Hampton, Va.) and Richard J. Margason Washington Dec. 1973 90 p refs Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Hampton, Va.
(NASA-TN-D-7314; L-8863) Avail: NTIS HC $3.75 CSCL 20D

The induced static pressures due to a highly underexpanded

sonic jet ejecting normally from a flat plate into a subsonic crosswind have been investigated. These pressure data have been recorded on the flat plate for a range of nominal jet-to-free-stream dynamic-pressure ratios from 0 to 1000 at free-stream Mach numbers of 0.1, 0.2, 0.4, and 0.6. The static pressure data measured on the flat plate are presented and correlated based upon the Riemann shock geometry in the jet plume. This data correlation improves with increasing free-stream Mach number.
Author

N74-11817*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL ROLL-DAMPING MEASUREMENTS OF A WINGED SPACE SHUTTLE CONFIGURATION IN LAUNCH ATTITUDE
Robert W. Hess and Edwin E. Davenport Washington Dec. 1973 21 p refs
(NASA-TN-D-7394; L-8991) Avail: NTIS HC $2.75 CSCL 01A

Ground-wind load studies were conducted on three model configurations to assess the importance of aeroelastic instabilities of erected space shuttle vehicles. Roll damping was measured on a fuselage-alone model, which had a D cross section, and a fuselage and tail surfaces in combination with either a clipped-delta wing or a low-sweep tapered wing as the primary lifting surface. The largest negative roll-damping coefficients were measured with the fuselage-alone configuration and were a function of wind azimuth. At the wind azimuths at which the wing-fuselage configuration was unstable, the negative roll-damping coefficients were a function of reduced frequency. author

N74-11818*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STREAMLINE CURVATURE DESIGN PROCEDURE FOR SUBSONIC AND TRANSONIC DUCTS
Raymond L. Barger Washington Dec. 1973 18 p refs
(NASA-TN-D-7368; L-8963) Avail: NTIS HC $2.75 CSCL 01A

A procedure for designing ducts for subsonic and transonic speeds is described. Examples discussed are a wind-tunnel contraction cone, a supersonic nozzle, and a diffuser. A listing of the computer program is included. The streamline curvature equations represent a form of the exact, compressible, inviscid flow equations. The method is applicable from low subsonic to supersonic speeds. Author

N74-11819*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CANARD-WING LIFT INTERFERENCE RELATED TO MANEUVERING AIRCRAFT AT SUBSONIC SPEEDS
Blair B. Gloss and Linwood W. Mckinney Washington Dec. 1973 35 p refs
(NASA-TM-X-2897; L-9096) Avail: NTIS HC $3.00 CSCL 01A

An investigation was conducted at Mach numbers of 0.7 and 0.9 to determine the lift interference effect of canard location on wing planforms typical of maneuvering fighter configurations. The canard had an exposed area of 16.0 percent of the wing reference area and was located in the plane of the wing or in a position 18.5 percent of the wing mean geometric chord above the wing plane. In addition, the canard could be located at two longitudinal stations. Two different wing planforms were tested: one with a leading-edge sweep angle of 60 deg and the other with a leading-edge sweep angle of 44 deg. The results indicated that although downwash from the canard reduced the wing lift at angles of attack up to approximately 16 deg, the total lift was substantially greater with the canard on than with the canard off. At angles of attack above 16 deg, the canard delayed the wing stall. Changing canard deflection had essentially no effect on the total lift, since the additional lift generated by the canard deflection was lost on the wing due to an increased downwash at the wing from the canard. Author

N74-11820*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPROXIMATIONS IN THE MINIMUM TIME-TO-CLIMB PROBLEM
Mark D. Ardema Aug. 1973 48 p refs
(NASA-TM-X-62292) Avail: NTIS HC $4.50 CSCL 01A

The minimum time-to-climb problem is formulated as a third order system and three approximate solutions based on reduced order systems are presented. The first of these is the often used energy state, the second is the less frequently used two state and the third is a slightly altered form of the second, herein called the modified two state. These three approximations are discussed and compared both qualitatively and, by using a numerical example, quantitatively. The numerical example is also solved by the steepest descent method to provide a basis for comparison. It is concluded that the modified two state approximation is significantly better than the other two. This approximation is used to assess the sensitivity of climb performance to various vehicle parameters and it is found that, as expected, thrust and weight influence the time-to-climb most strongly.
Author

N74-11821*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW SPEED AERODYNAMIC CHARACTERISTICS OF A 17 PERCENT THICK AIRFOIL SECTION DESIGNED FOR GENERAL AVIATION APPLICATIONS
Robert J. McGhee and William D. Beasley Washington Dec. 1973 71 p refs
(NASA-TN-D-7428; L-9132) Avail: NTIS HC $3.50 CSCL 01A

Wind-tunnel tests have been conducted to determine the low-speed two-dimensional aerodynamic characteristics of a 17-percent-thick airfoil designed for general aviation applications (GA(W)-1). The results were compared with predictions based on a theoretical method for calculating the viscous flow about the airfoil. The tests were conducted over a Mach number range from 0.10 to 0.28. Reynolds numbers based on airfoil chord varied from 2.0 million to 20.0 million. Maximum section lift coefficients greater than 2.0 were obtained and section lift-drag ratio at a lift coefficient of 1.0 (climb condition) varied from about 65 to 85 as the Reynolds number increased from about 2.0 million to 6.0 million. Author

N74-11822*# Rochester Applied Science Associates, Inc., N.Y.
EFFECT OF SWEEP ANGLE ON THE PRESSURE DISTRIBUTIONS AND EFFECTIVENESS OF THE OGEE TIP IN DIFFUSING A LINE VORTEX
John C. Balcerak and Raymond F. Feller 1973 123 p refs (Contract NAS1-12012)
(NASA-CR-132355; RASA-73-07) Avail: NTIS HC $8.25 CSCL 01A

Low-speed wind tunnel tests were conducted to study the influence of sweep angle on the pressure distributions of an ogee-tip configuration with relation to the effectiveness of the ogee tip in diffusing a line vortex. In addition to the pressure data, performance and flow-visualization data were obtained in the wind tunnel tests to evaluate the application of the ogee tip to aircraft configurations. The effect of sweep angle on the performance characteristics of a conventional-tip model, having equivalent planform area, was also investigated for comparison with the ogee-tip configuration. Results of the investigation generally indicate that sweep angle has little effect on the characteristics of the ogee in diffusing a line vortex. Author

N74-11823*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE PERFORMANCE OF A FAN-IN-WING VTOL CONFIGURATION
Harry H. Heyson Washington Dec. 1973 75 p refs
(NASA-TN-D-7498; L-9219) Avail: NTIS HC $3.50 CSCL 01C

The incompressible-flow momentum theory is extended to the case of lifting fans. The resulting theory includes many of the known experimentally determined characteristics of fan-in-wing aircraft. These characteristics include the negligible effect of forward speed on fan thrust, the large momentum drag, and the generally inefficient performance throughout the transition speed range. Although mutual interference between the fans and the wing was totally neglected, the theory is confirmed by experimental results for the configuration tested. Examination of

the results of an investigation of wall interference leads to the conclusion that the large fan-induced lift reported in many earlier investigations was largely the result of neglecting wall interference in the reduction of wind-tunnel data. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N74-11824 California Univ., Los Angeles.
THE DESIGN OF AN OPTIMAL ADAPTIVE LATERAL-DIRECTIONAL FLIGHT CONTROL SYSTEM FOR A HIGH-PERFORMANCE AIRCRAFT Ph.D. Thesis
Vincent James Darcy 1973 111 p
Avail: Univ. Microfilms Order No. 73-13133

The lateral-directional dynamics of a high-performance aircraft are modeled by a set of linear time-varying differential equations. Because a high-performance aircraft is capable of performing a wide variety of rapid maneuvers, the dynamic equations do not contain small-perturbation assumptions. An on-line real-time parameter identification scheme is developed to identify the time-varying parameters of the lateral-directional dynamic aircraft model. The identification scheme is an approximation technique with the practical assumption that the system noise statistics are not known. An adaptive lateral-directional flight controller is then developed based on a handling-quality model and the dynamic model of the aircraft. The controller combines the benefits of state-variable feedback with the benefits of series compensators. Dissert. Abstr.

N74-11825*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STUDY OF A CONTROL SYSTEM TO ALLEVIATE AIRCRAFT RESPONSE TO HORIZONTAL AND VERTICAL GUSTS
William H. Phillips Washington Dec. 1973 40 p refs
(NASA-TN-D-7278; L-8844) Avail: NTIS HC $3.00 CSCL 01C

A study is made of the longitudinal response of a STOL airplane equipped with a vanecontrolled gust-alleviation system. Effects of various combinations of design parameters on the responses to horizontal and vertical gusts and to elevator inputs are presented. Almost complete gust alleviation may be obtained with this system when the center of gravity of the STOL airplane is at rearward locations, but pitch stability augmentation is required for satisfactory control characteristics. Author

N74-11826*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC CHARACTERISTICS OF A LARGE-SCALE MODEL WITH A SWEPT WING AND A JET FLAP HAVING AN EXPANDABLE DUCT
Thomas N. Aiken, Kiyoshi Aoyagi, and Michael D. Falarski Sep. 1973 96 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffet Field, Calif.
(NASA-TM-X-62281) Avail: NTIS HC $7.00 CSCL 01C

The data from an investigation of the aerodynamic characteristics of the expandable duct-jet flap concept are presented. The investigation was made using a large-scale model in the Ames 40- by 80-foot Wind Tunnel. The expandable duct-jet flap concept uses a lower surface, split flap and an upper surface, Fowler flap to form an internal, variable area cavity for the blowing air. Small amounts of blowing are used on the knee of the upper surface flap and the knee of a short-chord, trailing edge control flap. The bulk of the blowing is at the trailing edge. The flap could extend the full span of the model wing or over the inboard part only, with blown ailerons outboard. Primary configurations tested were two flap angles, typical of takeoff and landing; symmetric control flap deflections, primarily for improved landing performance; and asymmetric aileron and control flap deflections, for lateral control. Author

N74-11827*# Kanner (Leo) Associates, Redwood City, Calif.
ON THE RELIABILITY OF RESULTS FROM THE TOWER TEST FOR FREE FLIGHT TESTS
H. Goerlich Washington NASA Nov. 1973 15 p Transl. into ENGLISH from West Ger. report DLR-Mitt-72-18, Oct. 1972 p 79-92 Presented at the 3rd meeting of the DGLR-Symposium, Flight Testing Technology: Reliability of Results Derived from Simulation in Comparison with Results of Actual Flight, Bremen, 28 Apr. 1972
(Contract NASw-2481)
(NASA-TT-F-15174; DLR-Mitt-72-18) Avail: NTIS HC $3.00 CSCL 01B

The determination of aerodynamic characteristics of aircraft while mounted on a fixed column is discussed. The construction of the test equipment to measure pitching and rolling moments is described. The advantages of using such a method as a complement to flight tests are outlined. Specific examples of tests conducted and the results obtained during captive tests are analyzed. Author

N74-11828# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AIRCRAFT FUEL SYSTEM TESTS WITH GELLED FUEL-FLOWMETER CALIBRATION, FUEL BOOST PUMP AND JETTISON TESTS Final Report, Dec. 1971 - Nov. 1972
Joseph A. Avbel Nov. 1973 29 p refs
(FAA Proj. 181-520-020)
(FAA-NA-73-43; FAA-RD-73-138) Avail: NTIS HC $3.00

The feasibility of using gelled fuel (nominal 250 centipoise viscosity) with full scale aircraft fuel system components was investigated. Tests indicated that turbine-type flowmeters are suitable for measuring flow rates with accuracies of 1 percent. Jettison and fuel feed operations were conducted using a B-57 wing fuel tank. Approximately 3 percent more gelled fuel than JP-5R remained in the tank after emptying the tank in both boost pump and jettison tests. Flow rates and times to empty the tank were significantly poorer with the gelled fuel when compared to the results obtained with the JP-5R fuel. The gelled fuel tested is considered unsatisfactory because of its instability in storage, causing wide variations in viscosity. Author

N74-11829*# Boeing Co., Wichita, Kans.
ANALYSIS OF AEROELASTIC MODEL STABILITY AUGMENTATION SYSTEMS Final Report
Frank D. Sevart Mar. 1971 202 p refs
(Contract NAS1-9808)
(NASA-CR-132354; D3-8390-4) Avail: NTIS HC $12.25 CSCL 01C

An analytical and mechanization study was conducted for two flutter stability augmentation systems. One concept uses only the wing trailing edge control surface. Another concept uses leading and trailing edge control surfaces operating simultaneously. The combined use of leading and trailing edge control surfaces should improve the surface coupling (controllability) with vertical bending and torsional structural modes and decrease the coupling between bending and torsional modes. The study was directed toward stability augmentation systems characteristics for the supersonic transport aircraft. Author

N74-11830# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: CONTINENTAL AIRLINES, SABRELINER MODEL NA-265-60, N743R, MONTROSE, COLORADO, 13 APRIL 1973
7 Nov. 1973 24 p
(NTSB-AAR-73-19) Avail: NTIS HC $3.25

An aircraft accident involving a Sabreliner aircraft which crashed after takeoff from the Montrose, Colorado airport on 13 April 1973 is reported. The aircraft struck the ground while in a steep left turn and nose down attitude. It was determined that the cause of the accident was continued operation of the left engine at climb power, after an unwanted in-flight deployment of the left engine thrust reverser, causing an uncontrollable flight condition. Author

N74-11831*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERSONIC AERODYNAMIC CHARACTERISTICS OF AN ALL-BODY RESEARCH AIRCRAFT CONFIGURATION
Louis E. Clark Washington Dec. 1973 46 p refs
(NASA-TN-D-7358; L-8971) Avail: NTIS HC $3.00 CSCL 01C

An experimental investigation was conducted at Mach 6 to determine the hypersonic aerodynamic characteristics of an all-body, delta-planform, hypersonic research aircraft (HYFAC configuration). The aerodynamic characteristics were obtained at Reynolds numbers based on model length of 2.84 million and 10.5 million and over an angle-of-attack range from minus 4 deg to 20 deg. The experimental results show that the HYFAC configuration is longitudinally stable and can be trimmed over the range of test conditions. The configuration had a small degree of directional stability over the angle-of-attack range and positive effective dihedral at angles of attack greater than 2 deg. Addition of canards caused a decrease in longitudinal stability and an increase in directional stability. Oil-flow studies revealed extensive areas of separated and vortex flow on the fuselage lee surface. A limited comparison of wind-tunnel data with several hypersonic approximations indicated that, except for the directional stability, the tangent-cone method gave adequate agreement at control settings between 5 deg and minus 5 deg and positive lift coefficient. A limited comparison indicated that the HYFAC configuration had greater longitudinal stability than an elliptical-cross-section configuration, but a lower maximum lift-drag ratio. Author

N74-11832*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND TUNNEL INVESTIGATION OF AN UPPER SURFACE BLOWN JET-FLAP POWERED-LIFT CONFIGURATION
Arthur E. Phelps, III (Army Air Mobility R and D Lab., Hampton, Va.) and Charles C. Smith, Jr. Washington Dec. 1973 61 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.
(NASA-TN-D-7399; L-9051) Avail: NTIS HC $3.50 CSCL 01A

An investigation has been conducted in the Langley full-scale tunnel to determine the performance and static stability and control characteristics of a four-engine, upper surface blown jet-flap powered-lift configuration with a swept wing. The investigation included test performed over a range of angle of attack (-4 deg to 36 deg), angle of sideslip (-5 deg to 5 deg), and thrust coefficients (0 to 4.32) for both symmetric and engine-out power conditions and for horizontal and vertical tails both on and off. In addition to the four-engine tests, a few tests were made with the outboard engines removed to simulate a twin-engine powered-lift transport configuration. Author

N74-11833*# Bell Helicopter Co., Fort Worth, Tex.
ADVANCEMENT OF PROPROTOR TECHNOLOGY. TASK 1: DESIGN STUDY SUMMARY
3 Sep. 1969 209 p refs
(Contract NAS2-5386)
(NASA-CR-114682; Rept-300-099-003) Avail: NTIS HC $12.50 CSCL 01C

A tilt-proprotor proof-of-concept aircraft design study has been conducted. The results are presented. The objective of the contract is to advance the state of proprotor technology through design studies and full-scale wind-tunnel tests. The specific objective is to conduct preliminary design studies to define a minimum-size tilt-proprotor research aircraft that can perform proof-of-concept flight research. The aircraft that results from these studies is a twin-engine, high-wing aircraft with 25-foot, three-bladed tilt proprotors mounted on pylons at the wingtips. Each pylon houses a Pratt and Whitney PT6C-40 engine with a takeoff rating of 1150 horsepower. Empty weight is estimated at 6876 pounds. The normal gross weight is 9500 pounds, and the maximum gross weight is 12,400 pounds. Author

N74-11834*# Bell Helicopter Co., Fort Worth, Tex.
ADVANCEMENT OF PROPROTOR TECHNOLOGY. TASK 2: WIND-TUNNEL TEST RESULTS
30 Sep. 1971 224 p refs
(Contract NAS2-5386)
(NASA-CR-114363; Rept-300-099-004) Avail: NTIS HC $13.25 CSCL 01C

An advanced-design 25-foot-diameter flightworthy proprotor was tested in the NASA-Ames Large-Scale Wind Tunnel. These tests, have verified and confirmed the theory and design solutions developed as part of the Army Composite Aircraft Program. This report presents the test results and compares them with theoretical predictions. During performance tests, the results met or exceeded predictions. Hover thrust 15 percent greater than the predicted maximum was measured. In airplane mode, propulsive efficiencies (some of which exceeded 90 percent) agreed with theory. Author

N74-11835*# Lockheed-California Co., Burbank.
STUDY OF QUIET TURBOFAN STOL AIRCRAFT FOR SHORT HAUL TRANSPORTATION
T. P. Higgins, E. G. Stout, and H. S. Sweet Washington NASA Dec. 1973 76 p refs
(Contract NAS2-6995)
(NASA-CR-2355) Avail: NTIS HC $3.75 CSCL 01C

Conceptual designs of Quiet Turbofan STOL Short-Haul Transport Aircraft for the mid-1980 time period are developed and analyzed to determine their technical, operational, and economic feasibility. A matrix of aircraft using various high-lift systems and design parameters are considered. Variations in aircraft characteristics, airport geometry and location, and operational techniques are analyzed systematically to determine their effects on the market, operating economics, and community acceptance. In these studies, the total systems approach is considered to be critically important in analyzing the potential of STOL aircraft to reduce noise pollution and alleviate the increasing air corridor and airport congestion. Author

N74-11836*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESULTS OF THE FLIGHT NOISE MEASUREMENT PROGRAM USING A STANDARD AND MODIFIED SH-3A HELICOPTER
Robert J. Pegg, Herbert R. Henderson, and David A. Hilton Washington Dec. 1973 91 p refs
(NASA-TN-D-7330; L-8950) Avail: NTIS HC $3.75 CSCL 20A

A field noise measurement program has been conducted using both a standard SH-3A helicopter and an SH-3A helicopter modified to reduce external noise levels. Modifications included reducing rotor speed, increasing the number of rotor blades, modifying the blade-tip shapes, and acoustically treating the engine air intakes and exhaust. The purpose of this study was to document the noise characteristics recorded on the ground of each helicopter during flyby, hover, landing, and take-off operations. Based on an analysis of the measured results, the average of the overhead, overall, ontrack noise levels was approximately 4 db lower for the modified helicopter than for the standard helicopter. The improved in-flight noise characteristics, and associated small footprint areas and time durations, were judged to be mainly due to tail-rotor noise reductions. The noise reductions were obtained at the expense of required power increases at airspeeds greater than 70 knots for the modified helicopter. Author

N74-11837*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPLORATORY SIMULATION STUDY OF A HEAD-UP DISPLAY FOR GENERAL AVIATION LIGHTPLANES
Randall L. Harris, Sr. and Donald E. Hewes Washington Dec. 1973 52 p refs
(NASA-TN-D-7456; L-8897) Avail: NTIS HC $3.50 CSCL 01C

The concept of a simplified head-up display referred to as a landing-site indicator (LASI) for use in lightplanes is discussed. Results of a fixed-base simulation study exploring the feasibility of the LASI concept are presented in terms of measurements of pilot performance, control-activity parameters, and subjective comments of four test subjects. These subjects, all of whom had various degrees of piloting experience in this type aircraft, performed a series of simulated landings both with and without the LASI starting from different initial conditions in the final approach leg of the landing maneuver. Author

N74-11838# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.

ON THE INSTABILITY OF A SOUND-INFLUENCED FREE JET Ph.D. Thesis - Tech. Univ. Berlin

Eberhard Pfizenmaier Porz, West Ger. 14 May 1973 168 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-69) Avail: NTIS HC $10.50; DFVLR, Porz, West Ger. 48.10 DM

The reaction of an axisymmetric free jet to disturbances excited by a sound-field was investigated. The sound-field was used as a diagnostic tool in order to synchronize disturbances in the free jet to a single Strouhal number. If the Strouhal number is small, disturbances are amplified exponentially. If the Strouhal number is high, the experiments no longer reveal exponential amplification, but standing wave patterns and even damped amplitudes. Agreement between stability theory and experimental results then fails. It was shown that structure of disturbances, found experimentally, can be understood as a superposition of two downstream traveling waves, namely, the exciting sound-wave and the excited instability wave.

Author (ESRO)

N74-11839# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

FLIGHT-BY-FLIGHT TESTS WITH NOTCHED SPECIMENS USING A WING UPPER SURFACE LOAD SPECTRUM [EINZELFLUGVERSUCHE AN KERBSTAEBEN MIT DEM KOLLEKTIV DER TRAGFLAECHENOBERDECKE]

D. Schuetz, H. Lowak, and E. Gassner 20 Dec. 1972 52 p refs In GERMAN Sponsored by Bundesmin. fuer Verteidigung

(LBF-FB-104/72) Avail: NTIS HC $4.75

Using a loading spectrum typical for wing upper surfaces of transport airplanes, flight-by-flight and constant amplitude tests with open hole specimens were carried out. The influence of omitting load cycles of the ground and airloads were determined. The validity of palmgren Miner rule was studied and improved by the incorporation of notch root residual stresses.

Author (ESRO)

N74-11840# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

GUST VELOCITIES ENCOUNTERED BY A 720-B TYPE AIRPLANE AND DERIVED BY MEANS OF A MODEL FOR CONTINUOUS TURBULENCE

O. Buxbaum and J. M. Zaschel May 1973 58 p refs Sponsored by Bundesmin. fuer Verteidigung

(LBF-FB-105/73) Avail: NTIS HC $5.00

The load factor increments for a Boeing 720 aircraft were recorded using a flight data recorder. Measurements were made of altitude and airspeed during 620 hours of flight tests. The vertical gust velocities were derived by assuming a von Kármán spectrum of turbulence and by means of the transfer function of the aircraft. The transfer function was calculated for eight degrees of freedom. The results are presented in functions of flight altitudes, routes of operation, and flight segments.

Author (ESRO)

N74-11841# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

A STANDARDIZED LOAD SEQUENCE FOR FLIGHT SIMULATION TESTS ON TRANSPORT AIRCRAFT WING STRUCTURES [STANDARDISIERTER EINZELFLUG-BELASTUNGSABLAUF FUER SCHWINGFESTIGKEITSVERSUCHE AN TRAGFLAECHENBAUTEILEN VON TRANSPORTFLUGZEUGEN]

D. Schuetz, H. Lowak, J. B. DeJonge, and J. Schijve 29 Mar. 1973 58 p refs In GERMAN Sponsored by Bundesmin. fuer Verteidigung Prepared jointly with Natl. Lucht- en Ruimtevaartlab.

(LBF-FB-106/73; NLR-TR-73) Avail: NTIS HC $5.00

A standardized load sequence was derived by averaging the theoretical and experimental frequency distributions of loads on the wing roots of transport aircraft. The sequence is considered to be representative for the load history of the wing root of transport aircraft. It is proposed to adopt the standardized sequence for various aeronautical fatigue testing purposes.

ESRO

N74-11842# National Aerospace Lab., Amsterdam (Netherlands). The Netherlands V/STOL Working Group.

THE FUTURE OF SHORT-HAUL AIR TRANSPORT WITHIN WESTERN EUROPE

Jun. 1973 69 p refs

(Rept-SP-73-001) Avail: NTIS HC $5.50

The potential growth of air transport in Western Europe is outlined. Some measures for the temporary solution of difficulties created by conventional takeoff and landing aircraft are discussed and it is concluded that the existing system will not be able to cope with the expected growth without extensive new facilities. The technology and prospects of several categories of aircraft with reduced, vertical or short takeoff and landing facilities are discussed. It is concluded that an extension of the present system by the incorporation of short-haul jet aircraft with reduced takeoff and landing offers the best compromise between relieving the noise and congestion problems and the economic penalties involved. A number of recommendations are given primarily related to relieving the problems of the present air traffic system and the introduction of the new aircraft categories. ESRO

N74-11843# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

REVIEW OF INVESTIGATIONS ON AERONAUTICAL FATIGUE IN THE FEDERAL REPUBLIC OF GERMANY, MAY 1969 - JUNE 1973

E. Gassner and O. Buxbaum Jun. 1973 140 p refs Presented at the 13th Conf. of the Intern. Comm. on Aeron. Fatigue, London, 1973

(LBF-S-108) Avail: NTIS HC $9.00

A review is presented of the work carried out in the field of fatigue of aircraft structures in Germany. Most of the subjects treated are fatigue test results from specimens and components including effects of surface treatment and corrosive environment. Other reports concern loads measured in service and their analysis. Investigations concerning cyclic stress-strain behavior as well as crack propagation, residual strength, and fracture toughness are also reported. ESRO

N74-11844# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Flugtechnik.

STUDY OF THE TEMPERATURE INFLUENCE ON INDUCED FLOW EFFECTS. PART 1: TEST EQUIPMENT FOR GROUND EFFECT INVESTIGATIONS USING CIRCULAR HOT AIR JETS Annual Report [UNTERSUCHUNGEN ZUM TEMPERATUREINFLUSS AUF INDUZIERTE STRAHLEFFEKTE. TEIL 1: VERSUCHSANLAGE FUER BODENEFFEKTUNTERSUCHUNGEN MIT RUNDEN HEISSLUFTSTRAHLEN JAHRESBERICHT ZUM FORSCHUNGSVORHABEN HA 514/3/19/26]

Manfred Strauber 20 Dec. 1971 60 p refs In GERMAN

(Grant NGL-39-007-040)

(IFD-8/71-Pt-1) Avail: NTIS HC $5.00

The design of a model vertical takeoff aircraft, consisting of an air heater, an air exhauster, a model propulsion system and ground plate, is described. Specifications for the various construction elements are given, control and operating ranges of the elements are discussed and the measuring devices applied are detailed. Calibration measurements were carried out. ESRO

N74-11845# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Flugtechnik.

STUDY OF THE TEMPERATURE INFLUENCE ON INDUCED FLOW EFFECTS. PART 2: INFLUENCE OF GROUND EFFECTS ON HOT-AIR JET MIXING IN STEADY ATMOSPHERIC AIR Annual Report [UNTERSUCHUNGEN ZUM TEMPERATUREINFLUSS AUF INDUZIERTE STRAHLEFFEKTE. TEIL 2: MISCHUNG EINES HEISSLUFTSTRAHLES IN RUHENDER UMGEBUNGSLUFT UNTER DEM EINFLUSS DES BODENS JAHRESBERICHT ZUM FORSCHUNGSVORHABEN HA 514/3]

Manfred Strauber 20 Dec. 1971 138 p refs In GERMAN

(IFD-9/71-Pt-2) Avail: NTIS HC $9.00

Jet speed, jet temperature, jet and nozzle geometry and height of propulsive unit measurements were carried out on a specially designed model of a vertical takeoff aircraft. The influence of ground effects on the jet properties was established. The

model used was shown to be an acceptable simulation apparatus for measuring jet mixing. ESRO

N74-11846# Boeing Aerospace Co., Seattle, Wash.
STOL TACTICAL AIRCRAFT INVESTIGATION. VOLUME 4: ANALYSIS OF WIND TUNNEL DATA: VECTORED THRUST/MECHANICAL FLAPS AND INTERNALLY BLOWN JET FLAPS Final Technical Report, 8 Jun. 1971 - 8 Dec. 1972
John R. Monk, Jerry L. Lee, and J. Patrick Palmer Wright-Patterson AFB, Ohio AFFDL May 1973 304 p refs 6 Vol.
(Contract F33615-71-C-1757; AF Proj. 653A)
(AD-766641; D180-14411-1-Vol-4; AFFDL-TR-73-19-Vol-4) Avail: NTIS CSCL 01/3

The report presents the analysis of 728 hours of testing, conducted in the Boeing V/STOL 20 x 20 ft. Wind Tunnel, on a model of a medium STOL transport with vectored thrust and jet flap powered-lift systems. The interactions between the two powered lift systems and the basic airplane aerodynamics are presented for a systematic series of configuration changes which include sweep and nacelle location. (Modified author abstract) GRA

N74-11847# Boeing Aerospace Co., Seattle, Wash.
STOL TACTICAL AIRCRAFT INVESTIGATION. VOLUME 5, PART 1: FLIGHT CONTROL TECHNOLOGY: SYSTEM ANALYSIS AND TRADE STUDIES FOR A MEDIUM STOL TRANSPORT WITH VECTORED THRUST/MECHANICAL FLAPS Final Technical Report, 8 Jun. 1971 - 8 Dec. 1972
Kenneth J. Crandall, David J. Maund, William E. Gerken, and James H. Vincent Wright-Patterson AFB, Ohio AFFDL Jan. 1973 254 p refs 6 Vol.
(Contract F33615-71-C-1757; AF Proj. 643A)
(AD-766642; D180-14412-1-Vol-5-Pt-1) Avail: NTIS CSCL 01/3

A program of flight control technology applicable to an Advance Medium STOL Transport (AMST) airplane equipped with a vectored-thrust powered lift system has been conducted. Low q moment producers were evaluated. Mathematical models (control laws) of control systems suitable for the STOL landing approach were defined. The effect of control system mechanization complexity on performance, weight, cost, safety, design risk, and vulnerability to small arms fire was evaluated. A candidate control system was selected and its performance was validated using a piloted moving base simulation. While this study specifically concerned control technology for airplanes equipped with the vectored thrust form of powered lift, the results are considered to have direct application to airplanes with other forms of powered lift, such as internally blown jet flaps and upper surface blown flaps. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N74-11848*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COLUMN DENSITIES RESULTING FROM SHUTTLE SUBLIMATOR/EVAPORATOR OPERATION
Robert J. Naumann 15 Oct. 1973 18 p
(NASA-TM-X-64794) Avail: NTIS HC $3.00 CSCL 10B

The proposed disposal of H2O from the shuttle fuel cell operation by ejecting it in vapor form through a supersonic nozzle at the rate of 100 lb/day has been investigated from the point of view of the possible interference to astronomical experiments. If the nozzle is located at the tail and directed along the shuttle longitudinal axis, the resulting column density will be less than 10 to th 12th power molecules/sq cm at viewing angles larger than 48 deg above the longitudinal axis. The molecules in the trail will diffuse rapidly. The column density contribution from molecules expelled on the previous orbit is 1.3 x 10 to the 8th power molecules/sq cm. This contribution diminishes by the inverse square root of the number of orbits since the molecules were expelled. The molecular backscatter from atmospheric molecules is also calculated. If the plume is directed into the flight path, the column density along a perpendicular is found to be 1.5 x 10 to the 11th power molecules/sq cm. The return flux is estimated to be of the order of 10 to the 12th power molecules/sq cm/sec at the stagnation point. With reasonable care in design of experiments to protect them from the backscatter flux of water molecules, the expulsion of 100 lb/day does not appear to create an insurmountable difficulty for the shuttle experiments. Author

N74-11849# Atomic Energy Commission, Washington, D.C.
ENERGY R AND D INVENTORY DATA BASE. BIBLIOGRAPHY, 1973
1973 439 p refs
Avail: NTIS HC $24.00

The bibliography provides separate listings which include: (1) index on authors, (2)simple index on corporate authors, (3) permuted index on titles, (3) energy sources (arranged according to the various types), (4) electric power generation (subdivided by type), and (5) energy demand and uses. D.L.G.

N74-11850# Los Alamos Scientific Lab., N.Mex.
PRELIMINARY STUDY OF OPEN-CYCLE SPACE POWER SYSTEMS
L. A. Booth and J. C. Hedstrom Jun. 1973 17 p refs
(Contract W-7405-eng-36)
(LA-5295-MS) Avail: NTIS HC $4.00

Specific masses of earth-orbiting electric power systems in the tens-of-megawatts range with lifetimes of a few hours are estimated. With the low total energy requirement corresponding to short operating times, open-cycle systems, consisting of a dispossable working fluid and a heat-engine power-conversion system, were chosen for study. Results indicate that open-cycle system masses are lower than optimistic projections of closed-cycle-system masses for operating times up to approximately 10,000 seconds. Author (NSA)

N74-11851# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
Si-Au SCHOTTKY BARRIER NUCLEAR BATTERY Ph.D. Thesis
A. N. Tse Nov. 1972 168 p refs Sponsored by AEC
(TID-26342) Avail: NTIS HC $7.60

A long life, high power density, high reliability, compact microwatt battery is needed in many applications. In the field of medicine, for example, such a battery could power an artificial pacemaker which would greatly extend the residence time of the device. Various alternatives are analyzed and discussed. Betavoltaic conversion systems with Si-Au Schottky barrier cells coupled with Pm 147 metal foil were selected for investigation. Characterization experiments were performed to obtain optimized silicon resistivity and promethium metal foil thickness. Radiation dose rates were measured and the safety aspects of the battery were analyzed. A prototype battery was assembled and tested. The economics of the battery were demonstrated for special applications. It is concluded that a microwatt nuclear battery can be built with a conversion efficiency of 1 to 2%, a power density of 60 to 300 microwatts/cu cm depending on the power level, and a useful life of 5 to 10 years. Further research areas are recommended. Author (NSA)

N74-11852# ARO, Inc., Arnold Air Force Station, Tenn.
DEVELOPMENT OF DESIGN CRITERIA, COST ESTIMATES, AND SCHEDULES FOR AN MHD HIGH PERFORMANCE DEMONSTRATION EXPERIMENT Final Report, Apr. 1972 - Apr. 1973
G. W. Garrison, T. R. Brogan, H. J. Schmidt, and J. J. Nolan AEDC Aug. 1973 119 p refs Sponsored by Office of Coal Res.
(ARO Proj. PF226)
(AD-766232; ARO-PWT-TR-73-75; AEDC-TR-73-115) Avail: NTIS CSCL 10/2

The successful application of magnetohydrodynamics (MHD) for commercial, coal-fired, base-load power generation requires that the generator have an energy extraction ratio of approximately 0.20 with a turbine efficiency of 70 percent. There is a significant

gap between this required performance and the generator performance which has been achieved to date. The commercial MHD concept is critically dependent upon the generator achieving this required performance, and it is therefore essential that a demonstration of this generator performance have the highest priority. Of equal importance, the generator channel configuration and operating conditions which are necessary in order to achieve the required performance will be determined while accomplishing the performance demonstration. Thus other Office of Coal Research (OCR) sponsored MHD research efforts can be directed toward the real problems and configurations as determined by solid experiments. (Modified author abstract) GRA

N74-12635 Parente (Robert B.), Los Angeles, Calif.
POWER SOURCE QUALITY
Robert B. Parente *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 3 p (For availability see N74-12580 03-34)
Copyright.

N74-12636 Federal Aviation Administration, Washington, D.C.
POWER CONDITIONING SYSTEM FOR FAA AIR ROUTE TRAFFIC CONTROL CENTERS
Anthony J. Froehlich and Alexander Kusko (Kusko (Alexander), Inc., Needham Heights, Mass.) *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12680* Auburn Univ., Ala.
SOLAR POWER GENERATION AND DISTRIBUTION
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 11 p refs (For availability see N74-12674 03-34)
CSCL 20M

N74-12682* Auburn Univ., Ala.
SOLAR ENERGY POTENTIAL
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 9 P ref (For availability see N74-12674 03-34)
CSCL 20M

N74-12683* Auburn Univ., Ala.
IMPACTS OF SOLAR ENERGY UTILIZATION
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 25 p refs (For availability see N74-12674 03-34)
CSCL 20M

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N74-11853*# Ohio State Univ., Columbus.
EVALUATION OF A PULSED ULTRASONIC DOPPLER FLOWMETER Final Report, 1 Nov. 1972 - 30 Sep. 1973
Michael K. Wells 30 Sep. 1973 25 p refs
(Grant NGR-36-008-193)
(NASA-CR-136151) Avail: NTIS HC $3.25 CSCL 06P

The in vivo application of the pulsed ultrasound Doppler velocity meter (PUDVM) for measuring arterial velocity waveforms is reported. In particular, the performance of the PUDVM is compared with a hot film anemometer of proven accuracy. Author

N74-11854*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SKYLAB MEDICAL EXPERIMENTS ALTITUDE TEST (SMEAT)
Richard S. Johnston, comp. Oct. 1973 300 p refs Prepared in cooperation with BioTechnology, Inc., Arlington, Va.
(Contract NASw-2518)
(NASA-TM-X-58115) Avail: NTIS HC $17.00 CSCL 06S

The Skylab 56-day environment simulation test provided baseline biomedical data on medical experiments to be included in the Skylab program. Also identified are problems in operating life support systems and medical equipment. For individual titles, see N74-11855 through N74-11880.

N74-11855* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INTRODUCTION
Richard S. Johnston *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 6 p (For availability see N74-11854 03-04)
CSCL 06S

The objective of the Skylab medical experiment altitude test was to provide a nearly full scale simulation of a 56-day Skylab mission for studying physiological changes produced in man by the long term exposure to space conditions. Evaluated in the altitude chamber tests were human cardiovascular/hemodynamic responses, musculoskeletal/metabolic effects, endocrine/electrode factors, and neurophysiological indices. G.G.

N74-11856* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROGRAM ORGANIZATION
In its Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 5 p (For availability see N74-11854 03-04)
CSCL 06S

The Skylab medical experiments altitude test plan is outlined. Described are the scope and objectives of the program, the management system under which it would be conducted, requirements for configuration of the test facility, test control documentation, data processing, and detailed test objectives. Author

N74-11857* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FACILITIES c11
Harold F. Battaglia, Frank A. Burgett, Lewis O. Casey, James V. Correale, Jack Q. Dunaway, Warren G. Glover, Arthur H. Hinners, Jr., James C. LeBlanc, Ted B. Leech, Jackie D. Mays et al *In* Its Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 29 p (For availability see N74-11854 03-04)
CSCL 14B

Detailed descriptions are provided for mechanical devices, life support systems, and data handling and communications instrumentation that are connected with the altitude chamber in which the Skylab medical experiments altitude tests were performed. G.G.

N74-11858* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LOWER BODY NEGATIVE PRESSURE, EXPERIMENT M092
R. L. Johnson, A. E. Nicogossian, M. M. Jackson, G. W. Hoffler, and R. A. Wolthuis *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 6 p refs (For availability see N74-11854 03-04)
CSCL 06S

Evaluation of orthostatic intolerance has been achieved by the use of lower body negative pressure (LBNP). The LBNP technique, though independent of gravity, simulates its effect by exposing the legs and the lower abdomen to reduced ambient pressures. This LBNP experiment, conducted during the 56-day simulation of the Skylab environment, was designed to supply baseline information on cardiovascular responses to periodic orthostatic stress. Impaired orthostatic tolerance, manifested by the increased heart rate, diminished systolic and pulse pressure, and increased tendency to syncope in the upright position, or during LBNP, was not observed in this experiment. Author

N74-11859* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
VECTOR CARDIOGRAM HARDWARE REPORT, EXPERIMENT M093 c05
Newton W. Allebach (Naval Aerospace Med. Inst.), Raphael F. Smith (Vanderbilt Univ.), and John Lintott *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 3 p (For availability see N74-11854 03-04)
CSCL 06B

The Skylab vectorcardiogram system was thoroughly tested during the 56-day SMEAT program. Except for a few problems

which were readily resolved, the equipment functioned very well. Author

N74-11860* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HEMATOLOGY/IMMUNOLOGY (M110 SERIES)
In its Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 5 p (For availability see N74-11854 03-04)
CSCL 06E

The hematology/immunology experiments in the Skylab mission study various aspects of the red blood cell, including its metabolism and life span, and blood volume changes under zero gravity conditions to determine the precise mechanism of the transient changes which have been seen on the relatively brief missions of the past. Author

N74-11861* Texas Univ., Austin. Medical Branch.
CYTOGENETIC STUDIES OF THE BLOOD (M111), PART A
Lillian H. Lockhart *In* NASA. Johnson Space Center Skylab Med. Altitude Test (SMEAT) Oct. 1973 3 p refs (For availability see N74-11854 03-04)
CSCL 06E

The cytogenetic study of the crew appears to indicate that Skylab-type environmental conditions have no deleterious effect upon chromosomal material. The findings are, however, less clear-cut than might be desired, due in large measure to confounding of the experimental design by the administration of isotope injections for the purposes of other experiments and to the lack of control subjects. Author

N74-11862* Texas Univ., Austin. Medical Branch.
INVESTIGATION OF MAN'S IMMUNE SYSTEM (M112), PART B
Stephen E. Ritzmann (Shriners Burns Inst.) and William C. Levin *In* NASA. Johnson Space Center Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 6 p refs (For availability see N74-11854 03-04)
CSCL 06E

Fifty-six days of residence in a Skylab-type environment produce essentially no change in the reactivity of the human immune system, as typified by the rate of RNA or DNA synthesis in small lymphocytes. The one point of divergence between the Skylab simulation crew and previous Apollo crews, a marked depression in synthesis rates on the fourteenth day after the chamber study, may be due to some technical difficulty in the experiment. Lymphocyte morphology changes paralleled functional changes. Author

N74-11863* Baylor Univ., Waco, Tex. Coll. of Medicine.
BLOOD VOLUME AND RED CELL LIFE SPAN (M113), PART C
Philip C. Johnson, Jr. *In* NASA. Johnson Space Center Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 4 p refs (For availability see N74-11854 03-04)
CSCL 06P

Prechamber, in-chamber, and postchamber blood samples taken from Skylab simulation crewmembers did not indicate significant shortening of the red cell life span during the mission. This does not suggest that the space simulation environment could not be associated with red cell enzyme changes. It does show that any changes in enzymes were not sufficiently great to significantly shorten red cell survival. There was no evidence of bone marrow erythropoetic suppression nor was there any evidence of increased red cell destruction. Author

N74-11864* Missouri Univ., Columbia. School of Medicine.
RED BLOOD CELL METABOLISM (M114), PART D
Charles E. Mengel *In* NASA. Johnson Space Center Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 2 p refs (For availability see N74-11854 03-04)
CSCL 06P

Statistically significant differences were found between Skylab simulation crews and controls for glycolytic enzymes. The absence of simultaneous controls for the pre- and postchamber analyses leaves the significance of the findings in the crew during these periods indeterminate. Author

N74-11865* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPECIAL HEMATOLOGIC EFFECTS (M115), PART E
S. L. Kimzey *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 12 p refs (For availability see N74-11854 03-04)
CSCL 06P

All routine hematological measurements for the Skylab simulation test were within normal astronaut population limits for the CDR, SPT, and PLT, with one exception: A significant lymphopenia was observed in the PLT during the post test period, possibly the reflection of increased adrenal corticoid secretion. No ultrastructural red cell membrane abnormalities were observed in any of the subjects, nor were any red corpuscle morphological abnormalities noted. Slight elevations in the FLT's red corpuscular potassium were observed in the younger corpuscles after chamber entrance and again upon egress. This probably represents newly released young red cells from hematopoietic tissue. Flame photometric analyses confirm the fact that potassium is indeed higher in the younger cells of all subjects examined. Author

N74-11866* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MINERAL BALANCE, EXPERIMENT M071
G. Donald Whedon (NIH), Paul C. Rambaut, and Malcolm C. Smith, Jr. *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 12 p refs (For availability see N74-11854 03-04)
CSCL 06P

Concern for the long term metabolic consequences of weightless flight was the basis for the conception of the Skylab medical experiment to measure mineral balance. Proper interpretation of obtained data that diminished atmospheric pressure has no appreciable effect, or at least no protective effect, on calcium metabolism. The absence of changes in calcium metabolism indicates that a stable baseline observation has been made for Skylab as far as the effects of atmosphere or calcium metabolism are concerned. Author

N74-11867* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPECIMEN MASS MEASUREMENT **c05**
William E. Thornton and Jack Ord (USAF Hospital, Clark AFB, Philippines) *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 16 p (For availability see N74-11854 03-04)
CSCL 05E

The Skylab specimen mass measurement device was operated throughout the altitude test in close simulation of the 56-day Skylab mission. It performed operational specimen measurements well until it was passed out of the chamber for replacement of the specimen hold-down and was autoclaved prior to return. Fecal measurements were typically made with less than one percent error. Author

N74-11868* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BONE MINERAL MEASUREMENT, EXPERIMENT M078
Paul C. Rambaut, John M. Vogel, John Ullmann, Scott Brown, and Fred Kolb, III *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 6 p refs Prepared in cooperation with Public Health Serv. Hosp., San Francisco (For availability see N74-11854 03-04)
CSCL 06P

Measurement tests revealed few deviations from baseline bone mineral measurements after 56 days in a Skylab-type environment. No mineral change was observed in the right radius. One individual, however, showed a possible mineral loss in the left os calcis and another gained mineral in the right ulna. The cause of the gain is unclear but may be attributable to the heavy exercise routines engaged in by the crewmember in question. Equipment problems were identified during the experiment and rectified. Author

N74-11869* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METABOLIC ACTIVITY, EXPERIMENT M171
E. L. Michel and J. A. Rummel *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 15 p (For availability see N74-11854 03-04)
CSCL 06P

The Skylab metabolic activity experiment determines if man's metabolic effectiveness in doing mechanical work is progressively altered by a simulated Skylab environment, including environmental factors such as slightly increased pCO2. This test identified several hardware/procedural anomalies. The most important of these were: (1) the metabolic analyzer measured carbon dioxide production and expired water too high; (2) the ergometer load module failed under continuous high workload conditions; (3) a higher than desirable number of erroneous blood pressure measurements were recorded; (4) vital capacity measurements were unreliable; and (5) anticipated crew personal exercise needs to be more structured. Author

N74-11870* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BIOASSAY OF BODY FLUIDS, EXPERIMENT M073
Carolyn S. Leach and Paul C. Rambaut *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 14 p refs (For availability see N74-11854 03-04)
CSCL 06P

Body fluids were assayed in this experiment to demonstrate changes which might have occurred during the 56-day chamber study in fluid and electrolyte balance, in regulation of calcium metabolism, in overall physiological and emotional adaptation to the environment, and in regulation of metabolic processes. Author

N74-11871* Baylor Univ., Houston, Tex.
SLEEP-MONITORING, EXPERIMENT M133
James D. Frost, Jr. and Joseph G. Salamy *In* NASA. Johnson Space Center Skylab Med. Expt. Altitude Test (SMEAT) 21 p refs Prepared in cooperation with Technol., Inc., Houston, Tex. (For availability see N74-11854 03-04)
CSCL 06S

The Skylab sleep-monitoring experiment simulated the timelines and environment expected during a 56-day Skylab mission. Two crewmembers utilized the data acquisition and analysis hardware, and their sleep characteristics were studied in an online fashion during a number of all night recording sessions. Comparison of the results of online automatic analysis with those of postmission visual data analysis was favorable, confirming the feasibility of obtaining reliable objective information concerning sleep characteristics during the Skylab missions. One crewmember exhibited definite changes in certain sleep characteristics (e.g., increased sleep latency, increased time Awake during first third of night, and decreased total sleep time) during the mission. Author

N74-11872* Fordham Univ., New York.
TIME AND MOTION, EXPERIMENT M151 c05
Joseph F. Kubis, J. T. Elrod, R. Rusnak, G. H. McBride, J. E. Barnes, and S. C. Saxon *In* NASA. Johnson Space Center Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 7 p (For availability see N74-11854 03-04)
CSCL 05E

Astronaut work performance during the preparation and execution of experiments in simulated Skylab tests was analyzed according to time and motion in order to evaluate the efficiency and consistency of performance (adaptation function) for several different types of activity over the course of the mission; to evaluate the procedures to be used by the same experiment in Skylab; to generate characteristic adaptation functions for later comparison with Skylab data; and to examine astronaut performance for any behavioral stress due to the environment. The overall results indicate that the anticipated adaptation function was obtained both for individual and for averaged data. Author

N74-11873* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ENVIRONMENTAL NOISE EXPERIMENT (DTO 71-22)
Jerry L. Homick and Millard F. Reschke *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 8 p refs Prepared in cooperation with Technol., Inc., Houston Tex. (For availability see N74-11854 03-04)
CSCL 06S

Only general conclusions can be reached of the effect of Skylab simulation chamber noise on the crewmen. Two crewmen experienced a small hearing decrement in-chamber, but there was no pattern as to the ear and frequency affected. Temporary hearing threshold shifts were observed in all three crewmen postchamber. These postchamber threshold shifts were perhaps the most significant finding of the study. However, no lasting detrimental effects on the crew's hearing were found. Author

N74-11874* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CREW MICROBIOLOGY (DTO 71-19)
B. C. Wooley, J. L. McQueen, R. C. Graves, B. J. Mieszkue, and G. R. Taylor *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 12 p (For availability see N74-11854 03-04)
CSCL 06M

States of microbial imbalance as a result of human altitude chamber confinement occurred, for the most part, only in those genera and species of bacteria, yeast, and fungi which are classified as transients and are not part of the true indigenous flora of the crewmembers. Inasmuch as no crew illness events occurred and only subtle changes in the indigenous flora were noted, it appears that confinement of 56-days in a Skylab simulated environment does not mediate toward shifts in bacterial populations which have obvious clinical significance. Author

N74-11875* Texas Univ., Houston. Dental Science Inst.
EFFECTS OF SMEAT ON THE ORAL HEALTH OF CREWMEN (DTO 71-2)
Lee R. Brown and Merrill G. Wheatcroft *In* NASA. Johnson Space Center Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 6 p refs (For availability see N74-11854 03-04)
CSCL 06E

The oral health status of three astronauts was monitored before, during and after a 56-day simulation of the Skylab mission. Laboratory and clinical parameters which are considered to be ultimately related to dental impairments were evaluated. The most notable changes were observed in increased counts of mycoplasma and S. mutans, decreased counts of enteric bacilli, decreased saliva flow rates, increased secretory IgA and salivary lysozyme levels, and increased clinical scores of dental plaque, calculus and inflammation. Author

N74-11876* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HABITABILITY/CREW QUARTERS, EXPERIMENT M487 c05
Robert L. Bond *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 11 p (For availability see N74-11854 03-04)
CSCL 06K

Skylab experiment M487, habitability crew quarters, is designed to provide an operational evaluation of the Skylab habitat by gathering data regarding the manner in which crewmen carry out their daily living and working routines during the missions. The success of the Skylab habitability experiment depends, in large measure, on the adequacy of the data collection instruments and the manner in which they are used. Author

N74-11877* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BIOMEDICAL SUPPORT SYSTEMS c05
R. M. Brockett, J. M. Ferguson, and S. M. Luczkowski *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 8 p (For availability see N74-11854 03-04)
CSCL 06B

Biomedical support hardware for SMEAT consisted basically of two systems, the inflight medical support system, and the operational bioinstrumentation system. The former is essentially a diagnostic and therapeutic kit; the latter is a belt equipped with sensors worn by the crewman to permit monitoring of his vital signs. Special attention was given during to the use and verification of the items in the systems so that changes required in the equipment could be pinpointed and effected prior to the Skylab mission. During the in-chamber testing, evaluations were made of the effectiveness of the proposed microbiology procedures, techniques, equipment, and the stability of media and reagents over the extended period of storage. Author

N74-11878* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

MEDICAL OPERATIONS: CREW SURGEON'S REPORT
Charles E. Ross *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 15 p (For availability see N74-11854 03-04)
CSCL 06E

To assure the safety and well being of the Skylab environment simulation crewmembers it was necessary to develop a medical safety plan with emergency procedures. All medical and nonmedical test and operations personnel, except those specifically exempted, were required to meet the medical standards and proficiency levels as established. Implemented programs included health care of the test crew and their families, occupational medical services for chamber operating personnel, clinical laboratory support and hypobaric and other emergency support.
Author

N74-11879* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CREW BACKGROUND, TRAINING, AND ACTIVITIES c05
In its Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 7 p (For availability see N74-11854 03-04)
CSCL 05E

The brief history of the Skylab altitude test crewmen is followed by an outline of their training in conducting medical experiments, emergency medical procedures, communications, and housekeeping practices during prolonged exposure to the Skylab simulation environment.
G.G.

N74-11880* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CREW REPORT c05
Karol J. Bobko, Robert L. Crippen, and William E. Thornton *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 46 p (For availability see N74-11854 03-04)
CSCL 05E

A 56-day chamber simulation of Skylab was successfully completed. The atmosphere (5 psi, 70 percent oxygen, 30 percent nitrogen, 5 mm carbon dioxide) and medical features including a 21-day pre- and 18-day post-test medical protocols were closely simulated. No apparent crew health problems were induced by the atmosphere, semiclosed environment, or other test features; and no appreciable crew degradation appeared over this period. The chamber and associated systems performed without major problems.
Author

N74-11881*# Scientific Translation Service, Santa Barbara, Calif.
THE RELATIONSHIP BETWEEN GAS EXCHANGE AND VOLUME PER MINUTE IN THE HEART FOR BATHS AT VARIOUS TEMPERATURES
Kl. Gollwitzer-Meier Washington NASA Nov. 1973 15 p refs Transl. into ENGLISH from Balneologe (Berlin), v. 4, 1973 p 58-63
(Contract NASw-2483)
(NASA-TT-F-15191) Avail: NTIS HC $3.00 CSCL 06P

The following were measured in cold and warm bath experiments with male and female subjects: gas exchange (O2 consumption), respiration, volume throughout of heart per unit of time, circulation, metabolism. The findings were interpreted and compared with earlier work.
Author

N74-11882*# Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF PROLONGED HYPOKINESIA ON THE HEART MUSCLE OF RATS
I. Prokhaska, I. V. Khavkina, and Z. I. Barbashova Washington NASA Dec. 1973 11 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 59, no. 8, Aug. 1973 p 1237-1241
(Contract NASw-2481)
(NASA-TT-F-15212) Avail: NTIS HC $3.00 CSCL 06C

The myocardium as a muscule functioning permanently and in conditions of hypokinesia is experimentally studied. Its efficiency and resistance to anoxic stress action and anaerobic energy exchange after 30-40 day hypokinesia are investigated. Experiments were performed on male white rats weighing 220-270 g. The technique is described in detail, and the results are presented in tables and diagrams, summarized as follows: 30-40 day hypokinesia leads to a sharp weight reduction throughout the test animals' entire body, their hearts, and particularly the right ventricle; one-month hypokinesia leads to a weakening of the contractile properties of the myocardium in rands at to a reduction of its resistance to acute oxygen deficiency; at the same time, the rate of anaerobic energy exchange is reduced, leading to the suspicion that it can be one of the components determining the new reduced resistance level of the myocardium.
Author

N74-11883*# Kanner (Leo) Associates, Redwood City, Calif.
TIME DEPENDENCE OF VISUAL PERCEPTION ON DIMENSIONS OF ALPHABET-NUMBER TEXT
E. A. Gilmutdinov and Ye. K. Kostyleva Washington NASA Dec. 1973 6 p refs Transl. into ENGLISH from Issled. po Bionike (USSR), no. 2, 1972 p 85-88
(Contract NASw-2481)
(NASA-TT-F-15219) Avail: NTIS HC $6.00 CSCL 05E

As the initial stage of research on determination of optimum symbol size, characters, contrast and symbol-background colors in visual information displays, determinations of visual perception time vs. character dimensions are presented. A special viewing device displaying groups of letter and number symbols of various sizes for a period of 5 seconds, designed to eliminate the need for visual adaptation for each trial, was used. Recording of perception time involves pronunciation of the symbol groups and release of the on button. Automatic advance of the symbol groups and stopwatch reset are provided. Groups of six to eight symbols, devoid of meaning, pronounceable in identical lengths of time and of a size not requiring movement of the eyeball were used as test objects.
Author

N74-11884*# National Aeronautics and Space Administration, Washington, D.C.
EFFECTS OF THE ELECTRICAL STIMULATION OF HUMAN MUSCLES DURING THE SIMULATION OF WEIGHTLESSNESS
L. I. Kakurin, B. B. Yegorov, Ye. I. Ilina, and M. A. Cherepakhin Dec. 1973 11 p refs Transl. into ENGLISH from paper presented at the 5th Intern. Man in Space Symp., Washington, D. C., Dec. 1973 10 p
(NASA-TT-F-15244) Avail: NTIS HC $3.00 CSCL 06P

During hypokinesia, in combination with electrical stimulation, tessallation of the ultrastructure of muscular fibers is observed. This relates to the forms and sizes of the michondria, density of the christa packing, the appearance of a large number of ribosomes and glycongen. In singular muscle fibers, necrotic sections were observed. It is concluded that electrical stimulation of the human muscles during space flight, together with physical training, provides a prophylactic effect in maintaining muscle tonus and preventing astrophy under the environmental conditions of limited mobility.
G.G.

N74-11885*# National Aeronautics and Space Administration, Washington, D.C.
CHARACTERISTICS OF METABOLISM DURING LONG WATER IMMERSION
R. A. Tigranyan Dec. 1973 12 p refs Transl. into ENGLISH of paper presented at the 5th Intern. Man in Space Symp., Washington, D.C., Dec. 1973 11 p
(NASA-TT-F-15245) Avail: NTIS HC $3.00 CSCL 06S

The effect of the organism of a 12-day stay in a water immersion medium (head on the water surface) was studied on 10 subjects. The condition of the metabolic processes in the subjects was judged from the investigation of the parameters of protein and carbohydrate metabolism, acid-base equilibrium, the activity of a number of enzymes and steroid hormones. The venous blood and diurnal urine served as the material for conducting the corresponding biochemical determinations.
Author

N74-11886*# National Aeronautics and Space Administration, Washington, D.C.
FUNCTIONAL TESTS IN THE STUDY OF WATER-SALT EXCHANGE AND RENAL FUNCTION IN COSMONAUTS
Yu. V. Natochin, G. I. Kozyrevskaya, and A. I. Grigoryev Dec. 1973 25 p refs Transl. into ENGLISH from the paper "Funktsionalnyye proby v Issledovanii Vodno-Solevogo obmena i Funktsii Pochek y kosmonavtov" USSR 25 p Presented at the 5th Intern. Man in Space Symp., Washington, D. C., Dec. 1973
(NASA-TT-F-15246) Avail: NTIS HC $3.25 CSCL 06P

The alteration in the water-salt exchange and renal activities of cosmonauts in polonged space flight was studied. The factors influencing these functions are considered. Tabulated results are presented and include the following: (1) electrolyte content, and osmotic concentration in blood serum of cosmonauts before flight, and after fligth; (2) elimination of fluid, electrolytes, and osmotically active substance before flight, and during first days after flight; and (3) dynamics of change in body weight after flight. It is concluded that space flight causes a decrease in the excretion of water by the kidneys, and a lowered capability to reabsorb sodium. The charges are attributed to a shift in the activity of the osmotic-and volume-regulation systems. F.O.S.

N74-11887*# National Aeronautics and Space Administration, Washington, D.C.
CERTAIN OTORHINOLARYNGOLOGICAL PROBLEMS IN MEDICAL SUPPORT OF SPACE FLIGHTS
I. I. Bryanov, E. I. Matsnev, and I. Ya. Yakovleva Dec. 1973 11 p refs Transl. into ENGLISH from the paper "Nekotoryye Otolaringologicheskiye Probelemy v Meditsinskom Obeschenii Kosmicheskikh Poletov" USSR 12 p Presented at the 5th Intern. Man in Space Symp., Washington, D. C., Dec. 1973
(NASA-TT-F-15247) Avail: NTIS HC $3.00 CSCL 06E

Problems in vestibulology, acoustics, and prophylaxis are discussed in relation to space flight. Studies are being directed to pathophysiological mechanisms of observed disorders among space crews. Modification of diagnostic instruments and methods for otorhinolarynogological diseases is also reviewed. J.A.M.

N74-11888*# National Aeronautics and Space Administration, Washington, D.C.
CHANGE IN THE FUNCTIONING OF THE VESTIBULAR ANALYSOR IN SPACE FLIGHT
N. N. Gurovskiy, I. I. Bryanov, and A. D. Yegorov Dec. 1973 17 p refs Transl. into ENGLISH of the paper "Izmeneniye Vestibulyarnogo Analizatora v Kosmicheskom Polete" USSR 18 p Presented at the 5th Intern. Man in Space Symp. Washington, D. C., Dec. 1973
(NASA-TT-F-15248) Avail: NTIS HC $3.00 CSCL 06P

Vestibular observations are made concerning the performance of space crews. Spatial illusions are discussed, along with vestibular-vegetative disorders. The effects of Coriolis accelerations in a weightless state on astronauts are also considered. J.A.M.

N74-11889*# Radiometric Technology, Inc., Wakefield, Mass.
STUDY OF BLOOD FLOW SENSING WITH MICROWAVE RADIOMETRY Final Report
Ronald A. Porter and Frank J. Wentz, III 5 Oct. 1973 89 p refs
(Contract NAS2-7087)
(NASA-CR-114675) Avail: NTIS HC $6.50 CSCL 06P

A study and experimental investigation has been performed to determine the feasibility of measuring regional blood flow and volume in man by means of microwave radiometry. An indication was expected of regional blood flow from measurement of surface and subsurface temperatures with a sensitive radiometer. Following theoretical modeling of biological tissue, to determine the optimum operating frequency for adequate sensing depth, a sensitive microwave radiometer was designed for operation at 793 MHz. A temperature sensitivity of of 0.06 K rms was realized in this equipment. Measurements performed on phantom tissue models, consisting of beef fat and lean beefsteak showed that the radiometer was capable of sensing temperatures from a depth between 3.8 and 5.1 cm. Radiometric and thermodynamic temperature measurements were also performed on the hind thighs of large dogs. These showed that the radiometer could sense subsurface temperatures from a depth of, at least, 1.3 cm. Delays caused by externally-generated RF interference, coupled with the lack of reliable blood flow measurement equipment, prevented correlation of radiometer readings with reginal blood flow. For the same reasons, it was not possible to extend the radiometric observations to human subjects. Author

N74-11890*# Scientific Translation Service, Santa Barbara, Calif.
GOLCI APPARATUS AND ORIGIN OF THE SECRETORY GRANULES IN ADENOHYPOPHYSEAL CELLS IN THE CELLS IN THE RAT. AUTORADIOGRAPHIC STUDIES WITH THE ELECTRON MICROSCOPE AFTER INJECTION OF TRITATED LEUCINE
J. Racadot, L. Olivier, E. Porcile, and B. Droz Washington NASA Nov. 1973 13 p refs Transl. into ENGLISH from C.R. Acad. Sc. Paris (France), v. 261, group 12, 11 Oct. 1965 p 2972-2974
(Contract NASw-2483)
(NASA-TT-F-15189) Avail: NTIS HC $3.00 CSCL 06C

Upon injection of tritiated leucine, the autoradiographic response first appears in the ergastoplasm. Then the first labelled secretory granules are detected in the Golgi apparatus (30 min.). Finally, the labelled secretory granules are dispersed in the cytoplasm, among the preexisting granules (90 minutes). It is deduced that the secretory granules originate in the Golgi apparatus from the newly formed proteins in the ergastoplasm. Author

N74-11891*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF DEHYDRATION ON PERFORMANCE IN MAN: ANNOTATED BIBLIOGRAPHY
John E. Greenleaf Dec. 1973 51 p refs
(NASA-TM-X-62308) Avail: NTIS HC $4.75 CSCL 06S

A compilation of studies on the effect of dehydration on human performance and related physiological mechanisms. The annotations are listed in alphabetical order by first author and cover material through June 1973. Author

N74-11892# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany). Abteilung Informationsverarbeitung.
AMANDA: AUTOMIZED MEDICAL ANAMNESIS DIALOG ASSISTANT
A. Seyferth, J. Encarnacao, and J. Negrete (Univ. Nacl. Autonoma de Mex.) 1972 298 p refs In GERMAN
(TB-147) Avail: NTIS HC $17.00

The AMANDA system, which was used to solve a medical problem using computer graphics, is described. The objective of the system is to allow the patient, before being examined by the doctor, to communicate with the computer as to the type and location of his ailment, in dialog mode. These graphic data are then converted by the system into a medical report for the doctor, and can be used as an aid in diagnosis and therapy determination. ESRO

N74-11893# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.
REACTIVATION OF TABUN INHIBITED ACETYLCHOLINE ESTERASE. REACTIVITY AND AFFINITY OF SOME PYRIDINIUM OXIMES [REAKTIVIERUNG TABUN-GEHEMMTER ACETYLCHOLINESTERASE. REAKTIVITAET UND AFFINITAET EINIGER PYRIDINIUMOXIME]
K. Schoene Bonn Bundeswehramt 1973 33 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-73-23) Avail: NTIS HC $3.75; Bundeswehramt 20 DM

The rate constants for the inhibition of acetylcholinesterase (AChE) by the esters of phospheric acid and tabun and paraoxon and the aging of the tabun inhibited enzyme were determined. From the concentration-dependence of the rate constants, terms for the reactivity and affinity of paraoxon and tabun towards AChE were calculated. With regard to these parameters, both alkylphosphates show only insignificant differences in their inhibitory potency. The rate constants of reactivation depend on the concentration of the reactivator. In a similar way constants for reactivity and affinity of some pyridinium oximes could be elevated. These data are about one order of magnitude lower than those determined by the reactivation of paraoxon-inhibited AChE. The results are discussed in connection with related experimental data from earlier experiments in vivo.
Author (ESRO)

N74-11894# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

BIOLOGICAL EFFECT OF FAST NEUTRONS ON RETICULOCYTE NUMBER AND SPLEEN WEIGHT OF MICE AFTER COMPLETE IRRADIATION [BIOLOGISCHE WIRKUNG SCHNELLER NEUTRONEN. RETIKULOZYTENZAHL UND MILZGEWICHT VON MAEUSEN NACH GANZKOERPER-BESTRAHLUNG]

F. J. OTTO Bonn Bundeswehramt 1973 38 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-73-24) Avail: NTIS HC $4.00; Bundeswehramt 20 DM

The neutron induced decrease in reticulocyte number in the peripheral blood of male mice is complete two days after neutron irradiation. At this time even low doses cause a maximal effect. The relative biological effectiveness of neutrons in reducing the reticulocyte count is 2.5 after low doses and 1.2 after high doses. The spleen of irradiated mice shows a marked loss of weight, with the lowest weight values observed the second day after irradiation. The relative effectiveness of neutrons in diminishing the spleen weight is 2.1 at low doses. The results are compared with previous findings on mortality response and leucocyte and lymphocyte decrease in mice after neutron irradiation. Reticulocyte and lymphocyte counts are useful indicators for the detection and evaluation of neutron damage in the sublethal dose range. Author (ESRO)

N74-11895# Stanford Research Inst., Menlo Park, Calif.
THE CAPACITY OF THE SOIL AS A NATURAL SINK FOR CARBON MONOXIDE Final Report

R. B. Ingersoll Dec. 1972 43 p refs

(Contracts CAPA-4-68(1-71); EPA-68-02-0307)

(PB-221641/4; SRI-LSU-1380-FR; CRC-APRAC-CAPA-4-68-6) Avail: NTIS HC $3.75 CSCL 06F

Studies were conducted to determine the potential magnitude of the soils of North America to serve as a sink for atmospheric carbon monoxide. In a series of field studies, soils were exposed in situ to experimental atmospheres containing CO. The influence of environmental factors was studied in the laboratory. The objectives were to: (1) determine the potential CO uptake of soils under natural conditions in the major ecological habitats of North America; (2) determine what influence environmental variables exert on the potential CO uptake rates of soils; and (3) estimate the potential of soils of North America to serve as a sink for atmospheric CO. Author (GRA)

N74-12342 Joint Publications Research Service, Arlington, Va.
EFFECT OF THE TEMPERATURE CONDITIONS IN THE SPRING AND NITROGEN SIDE DRESSING ON THE GROWTH, DEVELOPMENT AND YIELD OF WINTER WHEAT AND RYE

A. I. Korovin and V. M. Mokiyevskiy *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 54-60 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 78-83 (For availability see N74-12335 03-20)

N74-12343 Joint Publications Research Service, Arlington, Va.
EVALUATION OF PHYTOCLIMATE OF BARLEY AS A COVER CROP FOR RED CLOVER WITH HIGHLY DEVELOPED AGROTECHNICS

V. F. Panina *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 61-66 Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 84-88 (For availability see N74-12335 03-20)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N74-11896*# AiResearch Mfg. Co., Los Angeles, Calif.
WASH WATER RECOVERY SYSTEM Final Report

G. Deckman and J. Rousseau, ed. 10 Oct. 1973 105 p

(Contract NAS9-13026)

(NASA-CR-134122; Rept-73-9497) Avail: NTIS HC $7.25 CSCL 06I

The Wash Water Recovery System (WWRS) is intended for use in processing shower bath water onboard a spacecraft. The WWRS utilizes flash evaporation, vapor compression, and pyrolytic reaction to process the wash water to allow recovery of potable water. Wash water flashing and foaming characteristics, are evaluated physical properties, of concentrated wash water are determined, and a long term feasibility study on the system is performed. In addition, a computer analysis of the system and a detail design of a 10 lb/hr vortex-type water vapor compressor were completed. The computer analysis also sized remaining system components on the basis of the new vortex compressor design. Author

N74-11897# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
DYNAMIC PROPERTIES OF BONE AND SOME ENGINEERING CONSIDERATIONS IN THE DESIGN OF INTERNAL ORTHOPAEDIC PROSTHESES

V. Niranjan Jul. 1973 153 p refs

(UTIAS-190; CN-ISSN-0082-5255) Avail: NTIS HC $9.75

The behavior of human compact bone under compressive impact is investigated experimentally. A viscoelastic model is presented to give a satisfactory phenomenological description of bone over a wide range of strain rates. Storage fluids were found not to affect appreciably the elastic stiffness of human compact bone but caused a pronounced change of the viscous stiffness. A method of quantifying microscopic damage under impact is suggested and speculations are made on its relevance to spontaneous fractures. Some hypothetical composite materials are considered for possible use in internal orthopaedic prosthetic and fixative devices. Author

N74-11898# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
A TRAINING COURSE FOR AUDITIVE DOPPLER RADAR OPERATORS

C. L. Truijens 1973 23 p refs In DUTCH; ENGLISH summary

(IZF-1973-11) Avail: NTIS HC $3.25

The RASURA identification course, belonging to the RASURA equipment, proved to be unsatisfactory in practical use. An analysis was made of the imperfections of this course and it was decided to design a completely new course. A review is given of some of the literature about training for perceptual skills with special attention to whether either knowledge of results (KR) or cuing is the most efficient procedure. In an experiment three groups of eight subjects were trained to identify 18 RASURA signals. One group was trained with a KR procedure, the second with a cuing procedure and the third group was trained with a modified KR procedure in which the signal remained present during four seconds after the presentation of the correct name of the signal. No significant differences between these groups were found. A new course was composed, consisting of 14 lessons and 14 tests. In each of the lessons the first 10 signals are presented according to the cuing procedure and the following ones according to the KR procedure. Author

N74-11899*# Chemtric, Inc., Rosemont, Ill.
PRELIMINARY FLIGHT PROTOTYPE POTABLE WATER BACTERICIDE SYSTEM Final Report

W. J. Jasionowski and E. T. Allen Oct. 1973 154 p refs

(Contract NAS9-12792)

(NASA-CR-134135) Avail: NTIS HC $9.75 CSCL 06K

The development, design, and testing of a preliminary flight prototype potable water bactericide system are described. The system is an assembly of upgraded canisters composed of: (1) A biological filter; (2) an activated charcoal and ion exchange resin canister; (3) a silver chloride canister, (4) a deionizer, (5) a silver bromide canister with a partial bypass, and (6) mock-up instrumentation and circuitry. The system exhibited bactericidal activity against 10 to the 9th power Pseudomonas aeruginosa and/or Type IIIa, and reduced Bacillus subtilis by up to 5 orders of magnitude in 24 hours at ambient temperatures with a 1 ppm silver ion dose. Four efficacy tests were performed with a AgBr canister dosing anticipated fuel cell water. Tests show that a 0.05 ppm silver ion dose was bactericidal against 3 plus or minus 1 x 10 to the 9th power (5 plus or minus 1 x 10,000/ml

Pseudomonas aeruginosa and/or Type IIIa in 15 minutes or less. Author

N74-11900*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ULTRA-FLEXIBLE BIOMEDICAL ELECTRODES AND WIRES Patent Application
Salvadore A. Rositano, inventor (to NASA) Filed 13 Jul. 1973 19 p
(NASA-Case-ARC-10268-2; US-Patent-Appl-SN-379048) Avail: NTIS HC $3.00 CSCL 06B

A flexible, stretchable biomedical electrode and wire connector which is designed for use by physicians, medical technicians and researchers to connect an electric instrument to the body is described. The electrode and wire connector comprise a soft flexible elastomer which has been loaded with a conductive metallic powder to render it conductive. An important variation of the invention includes an insulating layer over the back and face of the electrode, the face insulation having one of more apertures therein which may be filled with conducting jelly for connecting the electrode to a body. NASA

N74-11901*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ULTRA-FLEXIBLE BIOMEDICAL ELECTRODE AND WIRES Patent Application
Salvadore A. Rositano, inventor (to NASA) Filed 13 Jul. 1973 19 p
(NASA-Case-ARC-10268-3; US-Patent-Appl-SN-379018) Avail: NTIS HC $3.00 CSCL 06B

A flexible, stretchable biomedical electrode and wire connector which is designed for use by physicians, medical technicians and researchers to connect an electric instrument to the body. The electrode and wire connector comprise a soft flexible elastomer which has been loaded with a conductive metallic powder to render it conductive. An important variation of the invention includes an insulating layer over the back of the electrode which may be continuous with an insulating layer over the back of the electrode which may be continuous with an insulating layer over the connecting wire. The invention provides a soft, flexible conductive electrode for biopotential measurements or stimulation which has a low contact potential and which has an electrical cable which will conform to the body contour during body motion. NASA

N74-11902# Department of Civil Aviation, Melbourne (Australia).
ARM REACH BOUNDARIES FOR COCKPIT CONTROL OPERATION
Margaret I. Bullock and Margaret A. Steinberg Jun. 1973 98 p refs
(Memo-31) Avail: NTIS HC $7.00

Because of the fact that light aircraft cockpits were designed when pilots were restrained by a lap belt only, the recent use of firm upper torso restraint has introduced a problem of control accessibility. Therefore, a determinination of the functional arm reach boundaries for the Australian male and female pilot populations has been made and certain structural anthropometric measurements have been recorded. The apparatus used, the experimental procedure and the various percentiles of thumb tip arm reach are described in this report. These data should provide information for the design or modification of restraint systems and of cockpits which will allow manipulation of manual controls by all pilots while effectively restrained. Author

N74-11903*# Southwest Research Inst., San Antonio, Tex.
APPLICATION OF NASA-DEVELOPED TECHNOLOGY TO THE AUTOMATIC CONTROL OF MUNICIPAL SEWAGE TREATMENT PLANTS Technical Report, 29 Jun. 1972 - 27 Sep. 1973
Lee L. Hiser and William R. Herrera Nov. 1973 33 p refs
(Contract NAS1-11726)
(NASA-CR-132340) Avail: NTIS HC $3.75 CSCL 06I

A search was made of NASA developed technology and commercial technology for process control sensors and instrumentation which would be applicable to the operation of municipal sewage treatment plants. Several notable items were found from which process control concepts were formulated that incorporated these items into systems to automatically operate municipal sewage treatment plants. A preliminary design of the most promising concept was developed into a process control scheme for an activated sludge treatment plant. This design included process control mechanisms for maintaining constant food to sludge mass (F/M) ratio, and for such unit processes as primary sedimentation, sludge wastage, and underflow control from the final clarifier. Author

N74-11904*# Stanford Univ., Calif. School of Engineering.
SYNTHETIC CARBOHYDRATE: AN AID TO NUTRITION IN THE FUTURE Final Report
Gerald A. Berman, ed. and Kate H. Murashige, ed. Jan. 1973 312 p refs
(Grant NGR-05-020-409)
(NASA-CR-136152) Avail: NTIS HC $17.75 CSCL 06H

The synthetic production of carbohydrate on a large scale is discussed. Three possible nonagricultural methods of making starch are presented in detail and discussed. The simplest of these, the hydrolysis of cellulose wastes to glucose followed by polymerization to starch, appears a reasonable and economic supplement to agriculture at the present time. The conversion of fossil fuels to starch was found to be not competitive with agriculture at the present time, but tractable enough to allow a reasonable plant design to be made. A reconstruction of the photosynthetic process using isolated enzyme systems proved technically much more difficult than either of the other two processes. Particular difficulties relate to the replacement of expensive energy carrying compounds, separation of similar materials, and processing of large reactant volumes. Problem areas were pinpointed, and technological progress necessary to permit such a system to become practical is described. Author

N74-11905# Anacapa Sciences, Inc., Santa Barbara, Calif.
THE USE OF WIDE-ANGLE CINEMATIC SIMULATORS IN PILOT TRAINING Final Report, Jun. 1970 - Jun. 1972
James J. McGrath Mar. 1973 153 p refs
(Contract N61339-70-C-0306)
(AD-766507; AS-TR-102-4; NAVTRAEQUIPC-70-C-0306-1) Avail: NTIS CSCL 05/9

In a previous program a wide-angle (160 deg) motion picture system was developed and 70-mm films were produced to simulate the visual experience of low-altitude flight. This study was conducted to evaluate and define the best application of this device to pilot training. Three training applications--chart interpretation, coastal entry orientation, and en route visual pilotage--were found to satisfy the criteria of being amenable to cinematic training, operationally important, and in need of improvement in the present training system. A training program involving a combination of classroom instruction and simulator practice was developed and described. In addition a separately titled report (NAVTRAEQUIPCEN Technical Report 70-C-0306-2), Chart interpretation in Low Altitude Flight was produced. This volume summarizes the special characteristics of the low-altitude visual scene and the inherent limitations of aeronautical charts as representations of the earth's surface. It is intended to supplement the training received in the proposed cinematic simulator. (Modified author abstract) GRA

N74-11906# Joint Publications Research Service, Arlington, Va.
DEVICE FOR SEPARATION OF BIO-ELECTRICAL SIGNALS DURING THE EFFECT OF HIGH-FREQUENCY ELECTRIC CURRENTS ON THE ORGANISM
A. M. Rybakov 13 Nov. 1973 10 p refs Transl. into ENGLISH from Med. Tekhn. (Moscow), no. 4, 1973 p 19-23
(JPRS-60514) Avail: NTIS HC $3.00

A description is requested of a device for the seperation of bioelectrical signals during the effect of high frequency electric currents on the organism. Author

N74-11907# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
HUMAN ENGINEERING INVESTIGATIONS ON DRIVING HIGH-SPEED TRACKED VEHICLES [UNTERSUCHUNG ANTHROPOTECHNISCHER PROBLEME BEI DER FUEHRUNG SCHNELLFAHRENDER KETTENFAHRZEUGE]
K. D. Schulz-Helbach, E. Donges, and G. Rothbauer Apr. 1973

188 p refs In GERMAN; ENGLISH summary
(FB-9) Avail: NTIS HC $11.50; Forschungsinst. fuer Anthropotech., Meckenheim, West Ger. 10 DM

Two human engineering investigations on driving in a high speed tracked vehicle are described. One concerns steering characteristics and the other driver aiding by means of a closed-loop television system. The experiments were conducted using a vehicle simulator for road driving which includes a synthetically generated visual simulation. The steering characteristic investigation showed that the step-like changes in steering sensitivity brought about by gear shifting operations within the transmission may lead to dangerous situations in the curve following. These situations can be avoided by using steering characteristics of which the sensitivity is inversely proportional to the vehicle speed. Investigations with the driver television system showed that specially reduced viewing angles associated with an insufficiently large image field, had a detrimental effect on driving behavior. By using an additional collimating optical system to achieve image field magnification. These effects can be significantly overcome. Author (ESRO)

N74-11908# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
AN IMPROVED MEASURING SYSTEM FOR QUANTIFICATION OF SURFACE ELECTROMYOGRAPHY [EIN VERBESSERTES MESS-SYSTEM ZUR QUANTITATIVEN OBERFLAECHEN-MYOGRAPHIE]
G. Rau Jun. 1973 34 p refs In GERMAN; ENGLISH summary
(Anthro-Mitt-2/73) Avail: NTIS HC $3.75; Forschungsinst. fuer Anthropotech., Mechkenheim, West Ger. 6 DM

An electromyography (EMG) amplifier system for surface electromyography was developed. Two suction cup electrodes and the electronic input stage form a small and handy device. A very high input impedance (> 200 MOhm) is chosen to suppress influences of the complex skin resistance on the EMG signal. Different ways of signal processing for quantifying surface EMG are discussed. A procedure comprising a double wave rectification and a special averaging filter has been chosen, which can easily be constructed. Measurements were made concerning the relationship between the static extension torque at the wrist and the processed EMG activity obtained at the m. extensor carpi radialis longus. Even without normalizing the EMG values to a reference value, the reproducibility of the relationship was within about 10% or less during a period of 1 week.
Author (ESRO)

N74-11909# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
DISCUSSION ON THE NATURE OF NORMAL FINGER TREMOR USING MODEL ANALOGIES [EINIGE MODELLUEBERLEGUNGEN ZUR NATUR DES NORMALEN FINGERTREMORS]
G. Rau Jul. 1973 20 p refs In GERMAN; ENGLISH summary
(Anthro-Mitt-3/73) Avail: NTIS HC $3.00; Forschungsinst. fuer Anthropotech., Meckenheim, West Ger. 6 DM

Forefinger tremor shows an acceleration frequency spectrum in the frequency range from about 5 Hz to 40 Hz with a sharp peak at about 20 - 25 Hz. The spectrum of the electromyography (EMG) pulsations at the corresponding muscle is more extended with a flat maximum at about 15 Hz. An extra mass (up to 90 g) added to the forefinger caused a shift of the peak in the acceleration spectrum to lower frequencies, the EMG spectrum being unchanged. These properties are described adequately by a model of a mechanical second order linear filter being excited by a broad band of muscular strength corresponding to the EMG spectrum. It can be estimated on the basis of the tremor amplitudes that the related amplitudes of muscle length cause excitations of the muscle spindles which remain subthreshold. The findings are in contrast to the hypothesis considering the reflex loop to be the origin of physiological finger tremor. Author (ESRO)

N74-11910# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
CARBON DIOXIDE MONITORING Final Technical Report, 1 Mar. - 14 Jul. 1973
Philips Biernacki and John J. Kalvinskas 14 Aug. 1973 94 p refs
(Contract N00014-73-C-0205)
(AD-765342; C73-447/501) Avail: NTIS CSCL 06/11

The program was initiated to establish the feasibility of applying bioluminescent technology for monitoring of carbon dioxide (CO_2) in life-support systems for divers, swimmers and underwater habitats. Experiments were performed to obtain bioluminescent cultures which are sensitive to levels of carbon dioxide as low as 81 ppm, in an 80% helium and 20% oxygen (life-support) gas mixture--at hydrostatic pressures up to 1000 psig. Fourteen luminescent cultures were tested under conditions of varying pressures, gas proportions, sample sizes, and flow rates. Strong responses to low concentrations of CO_2 were exhibited by five cultures--thereby demonstrating the feasibility of employing a luminescent detection system in the environments of interest. The luminescent responses were sensed by a photomultiplier tube. The photomultiplier output was fed through a log amplifier to a strip-chart recorder. This detection system was more than adequate for laboratory measurements; however, the requirements for a more compact system were also examined. It appears that--by using a solid-state sensor and integrated-circuit electronics--a small, low-power, portable unit can be developed and constructed. This unit would provide fail-safe monitoring of CO_2 in underwater life-support systems. Author (GRA)

N74-11911# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RELIABILITY AND EFFICIENCY OF THE MAN-CHECK SYSTEM COMPLEX
A. I. Gubinskii 27 Jul. 1973 18 p refs Transl. into ENGLISH from the monograph "Psikhologiya v Priborostr., Sb. Inzh." USSR, 1967 p 131-139
(AD-764975; FTD-HT-23-693-73) Avail: NTIS CSCL 05/10

In systems where one of the subsystems is man, it is obviously necessary to consider also his reliability. GRA

N74-11912# Southwest Research Inst., San Antonio, Tex.
EVALUATE AIRBAG RESTRAINTS FOR SUBCOMPACT CAR PASSENGERS. VOLUME 2: FINAL PROGRAM REPORT Final Report, 29 Jun. 1971 - 13 Nov. 1972
J. D. Michie and M. E. Bronstad May 1973 225 p refs
(Contract DOT-HS-024-1-165)
(PB-222203/2; DOT-HS-800832) Avail: NTIS HC $6.75 CSCL 13L

An experimental program was conducted to gather data on the performance of two currently available airbag restraint systems for passengers of subcompact cars. Twenty sled tests and four full-scale crashes were conducted using various arrangements of anthropometric dummies. Both the vehicles and the dummies were instrumented and highspeed movies were taken. Evaluation of airbag restraint systems was made. GRA

N74-11913# Southwest Research Inst., San Antonio, Tex.
EVALUATE AIRBAG RESTRAINTS FOR SUBCOMPACT CAR DRIVERS. VOLUME 2: FINAL PROGRAM REPORT Final Report, 29 Jun. 1971 - 13 Nov. 1972
J. D. Michie and M. E. Bronstad May 1973 235 p refs
(Contract DOT-HS-024-1-164)
(PB-222318/8; DOT-HS-800834) Avail: NTIS HC $5.75 CSCL 13L

For Abstract See N74-11912

N74-11914# Air Force Human Resources Lab., Brooks AFB, Tex.
AUTOMATED PILOT PERFORMANCE ASSESSMENT IN THE T-37: A FEASIBILITY STUDY Final Report, May 1968 - Apr. 1971
Patricia A. Knoop and William L. Welde Apr. 1973 458 p refs
(AF Proj. 6114)
(AS-766446; AFHRL-TR-72-6) Avail: NTIS CSCL 05/9

Research was conducted to develop a capability for quantification and assesment of in-flight pilot performance for utilization in undergraduate pilot training. The feasibility effort was directed to overcoming disadvantages of the traditional subjective rating of a pilot trainees performance by the instructor pilot through the development of an automated, objective performance measure-

ment system that possesses the characteristics of reliability, validity, and sensitivity. A T-37 B was instrumented to digitally record 24 flight and engine parameters. Computer software was developed to reduce, calibrate, and analyze data from lazy 8 and barrel roll maneuvers, and compute performance measures. (Modified author abstract) GRA

N74-11915# Naval Training Equipment Center, Orlando, Fla. Training Analysis and Evaluation Group.
TASK ANALYSIS OF PILOT, COPILOT, AND FLIGHT ENGINEER POSITIONS FOR THE P-3 AIRCRAFT Final Report
Robert F. Browing, John K. Lauber, and Paul G. Scott Jul. 1973 286 p
(AD-766445; TAEG-7) Avail: NTIS CSCL 05/9

The report provides a task analysis of the pilot, copilot, and flight engineer positions in the P-3 aircraft and delineates the method employed in translating task analysis data into an improved training system. It identifies the behavioral activities of the pilot, copilot, and flight engineer during normal, abnormal, and emergency operations. It contains a method for translation of task analytic data into syllabi, lesson guides, and lesson plans. GRA

N74-11859* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
VECTOR CARDIOGRAM HARDWARE REPORT, EXPERIMENT M093
Newton W. Allebach (Naval Aerospace Med. Inst.), Raphael F. Smith (Vanderbilt Univ.), and John Lintott *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 3 p (For availability see N74-11854 03-04)
CSCL 06B

N74-11867* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPECIMEN MASS MEASUREMENT
William E. Thornton and Jack Ord (USAF Hospital, Clark AFB, Philippines) *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 16 p (For availability see N74-11854 03-04)
CSCL 05E

N74-11872* Fordham Univ., New York.
TIME AND MOTION, EXPERIMENT M151
Joseph F. Kubis, J. T. Elrod, R. Rusnak, G. H. McBride, J. E. Barnes, and S. C. Saxon *In* NASA. Johnson Space Center Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 7 p (For availability see N74-11854 03-04)
CSCL 05E

N74-11876* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HABITABILITY/CREW QUARTERS, EXPERIMENT M487
Robert L. Bond *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 11 p (For availability see N74-11854 03-04)
CSCL 06K

N74-11877* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BIOMEDICAL SUPPORT SYSTEMS
R. M. Brockett, J. M. Ferguson, and S. M. Luczkowski *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 8 p (For availability see N74-11854 03-04)
CSCL 06B

N74-11879* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CREW BACKGROUND, TRAINING, AND ACTIVITIES
In its Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 7 p (For availability see N74-11854 03-04)
CSCL 05E

N74-11880* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CREW REPORT
Karol J. Bobko, Robert L. Crippen, and William E. Thornton *In its* Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 46 p (For availability see N74-11854 03-04)
CSCL 05E

N74-12588 California Univ., Berkeley.
ELECTRONIC INSTRUMENTATION FOR BLOOD FLOW MEASUREMENT AND TISSUE ANALYSIS
J. R. Singer IN WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs (For availability see N74-12580 03-34)
(Grants FR-7006; ASC-IN87D)
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N74-12589 Stanford Univ., Calif. Dept. of Electrical Engineering.
INTEGRATED CIRCUITS FOR AN IMPLANTABLE BLOOD FLOWMETER
David M. DiPietro (Hewlett-Packard Co., Santa Clara, Calif.) and James D. Meindl *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
(Contract N00014-67-A-0112-0044; Grant GM-17940-02)
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N74-12590 Stanford Univ., Calif. Electronics Labs.
A ONE-HAND OPTACON
Roger D. Melen *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 3 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12591 California Univ., Berkeley. Dept. of Electrical Engineering and Computer Sciences.
ENGINEERING-TYPE MODELS OF INFECTIOUS DISEASES
Edwin R. Lewis and Keh-Low Lee *In* WESCON The 1973 WESON Tech. Papers, Vol. 17 1973 9 p refs (For availability see N74-12580 03-34)
(Grant NSF GK-3845)
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N74-12600 California State Univ., Long Beach.
NEEDS AND TRENDS IN MEDICAL ELECTRONICS 1973: SESSION 13 OVERVIEW
Morton D. Schwartz *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

N74-12601 University of Southern Calif., Los Angeles. Biomedical Engineering Inst.
CLINICAL ENGINEERING AND THE MEDICAL INSTRUMENTATION MARKETS
Malcom G. Ridgway *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12602* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MEDICAL ELECTRONICS: A NEED AND A CHALLENGE
John Dimeoff *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

N74-12603 Western Electronic Show and Convention, Los Angeles, Calif.
RECENT COMMERCIAL MEDICAL ELECTRONIC DEVELOPMENTS IN CARDIOVASCULAR AND CANCER TREATMENT
Norman A. Austin *In its* The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)
Copyright.

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N74-11916 California Univ., Santa Barbara.
PROPERTIES AND USES OF SILVER SOLID ELECTROLYTES Ph.D. Thesis
Freddy Chen 1972 229 p
Avail: Univ. Microfilms Order No. 73-8111

Some silver electrolytes were studied including: AgBr, RbAg4I5, and Ag3SBr. The studies included: development of techniques for vacuum deposition of silver halides, determination of relationships between electrochemical properties of the silver halide films with film orientation, crystal size and structure, and finally development of applications for the electrolytes. Silver bromide films were prepared by evaporating AgBr pellets at 600 C at a pressure of < 0.0001 torr. Films as thick as 20 microns could be obtained. Rubidium silver iodide films were prepared by evaporating a RbI:AgI mixture source at a pressure of < 0.0001 torr at 500 C. The source contained 83 - 85 mole % AgI. Films as thick as 20 microns could be obtained. To avoid decomposition of RbAg4I5, the substrate temperature had to be higher than 27 C. Silver bromide films deposited over gold films at 25 C were randomly oriented and had crystal sizes of about 0.2 microns diameter, while AgBr films deposited over gold films at 280 C were (111) oriented and had crystal sizes of about 2 microns diameter. Dissert. Abstr.

N74-11917 Cornell Univ., New York.
COUPLED NONLINEAR OPTICAL PROCESSES AND OPTICAL PARAMETRIC GENERATION IN LITHIUM IODATE Ph.D. Thesis
Anthony Joseph Campillo 1973 136 p
Avail: Univ. Microfilms Order No. 73-14694

Continous wave spontaneous parametric scattering experiments in lithium iodate using an argon ion laser are described. An accurate determination of the absolute value of d sub 31 of lithium iodate was obtained: 1.8 x 10 to the minus 8th power esu. This value and accurate relative values allow a very good estimate to be made of d sub 36 of KDP, used as a reference nonlinear coefficient, of 1.5 x 10 to the minus 9th power esu. Additional data obtained include parametric tuning curves and estimates of IR ordinary indices of refraction. These studies indicate that lithium iodate is a suitable material for the construction of parametric oscillators to wavelengths as long as 5 micron. Experimentally determined properties of pulsed lithium iodate doubly resonant and singly resonant parametric oscillators are presented. Dissert. Abstr.

N74-11918 Stanford Univ., Calif.
SATURATION SPECTROSCOPY IN ATOMIC SODIUM AND HYDROGEN USING A TUNABLE DYE LASER Ph.D. Thesis
Issa Salim Shahin 1973 172 p
Avail: Univ. Microfilms Order No. 73-14975

The development of a narrow band tunable dye laser and its application, for the first time, in very high resolution optical spectroscopy using the elegant, and relatively simple technique, of saturation spectroscopy is discussed. The dye laser is pumped by a commercial pulsed nitrogen laser at 3371 A with 100 kW output peak power of 10 nsec pulse length and 100 pps maximum repetition rate. Coarse tuning of the dye laser is done by an Echelle grating of large blaze angle which forms one end of the laser cavity. An intracavity beam expanding telescope provides better collimation and higher resolution. Fine tuning is done by mechanically tilting an intracavity Fabry-Perot etalon. The laser bandwidth is reduced by the etalon from about 0.03 A at peak powers, of 20 kW, 5 nsec pulse width to 300 MHz at 2 to 4 kW. For very high resolution, further reduction of bandwidth to about 7 MHz was achieved using an extracavity confocal Fabry-Perot interferometer. Dissert. Abstr.

N74-11919 Texas Univ., Austin.
THE EFFECT OF IRON AND SULFUR ON THE ACTIVITY OF OXYGEN IN LIQUID COPPER Ph.D. Thesis
James Harrison Ford 1972 104 p
Avail: Univ. Microfilms Order No. 73-18421

Solid state electrolyte cell measurements of oxygen activity in liquid copper, Cu-Fe alloys, and Cu-S alloys were made at 1100, 1150, and 1200C in the composition ranges 100 to 800 ppm oxygen, 10 to 1100 ppm sulfur, and 0 to 2% iron. Oxygen content of the samples was varied by coulometric titration. The emf output of the cells were found to be reproducible as the oxygen contents reached the same value from either forward or reverse titration. Between 1100 deg and 1200C the magnitude of the cell emf increased with increasing temperature for the entire range of compositions. The computed values for the oxygen activity coefficient in liquid copper were found to be in good agreement with those reported in the literature. Within experimental error the activity coefficient in liquid copper was found to be approximately constant over the range of oxygen contents examined. Dissert. Abstr.

N74-11920 West Virginia Univ., Morgantown.
ANALYTICAL APPLICATIONS OF ELECTROSORPTION ON A PACKED GRAPHITE ELECTRODE Ph.D. Thesis
Kenneth Lee Dunlap 1972 78 p
Avail: Univ. Microfilms Order No. 73-12958

A study of electrosorption on an electrode of graphite particles from a solution flowing through the electrode has been undertaken to determine the feasibility of using the electrosorption as concentrating technique for the analysis of trace amounts of particular substances. Adsorption of inorganic cations on the electrode was not observed in this investigation; however, certain organic compounds were found to be electrosorbed on the graphite column when solutions containing them were pumped through the column. In general the capacity of the column for these organic compounds increased as the potential applied to the column was made more positive until a value of about + IV (vs. the Ag/AgCl reference electrode) was reached. In addition to the potential dependence, the capacity of the column was found to be dependent upon flow rate, concentration of the adsorbate, and the pH of the solution. From further study of column capacity and theses variables, it was concluded that electrosorption could be used as a method for concentrating dilute solutions of certain organic compounds for analysis.
Dissert. Abstr.

N74-11921 British Library Lending Div., Boston Spa (England).
SOME QUESTIONS ON THE KINETICS OF ELECTRODE PROCESSES IN THE ELECTROLYTICAL PRECIPITATION OF NICKEL
V. V. Zarechanskaya and E. F. Speranskaya 3 Sep. 1973 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. (Moscow), no. 13, 1970 p 676-680
(BLL-OA-Trans-1268-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The kinetics of the processes on the Ni-Pt and Ni-Hg electrodes have been investigated. The exchange currents and transfer coefficients alpha and beta have been calculated. The order has been determined of the anode reaction (for hydroxyl ions) of nickel oxidation on the above electrodes in an alkaline solution. Author

N74-11922*# Whittaker Corp., San Diego, Calif. Research and Development Div
DEVELOPMENT OF MODIFIED POLY (PERFLUOROPROPYLENEOXIDE) URETHANE SYSTEMS FOR USE IN LIQUID OXYGEN AND IN ENRICHED 100 PERCENT OXYGEN ATMOSPHERE Final Report, 22 Apr. 1971 - 23 Aug. 1973
Edward S. Harrison Sep. 1973 67 p
(Contract NAS8-27087)
(NASA-CR-120104; WRD-MJO-3028) Avail: NTIS HC $5.50 CSCL 07D

This program consisted of two separate though related phases. The initial phase was directed toward improving the mechanical and adhesive properties of the very highly fluorinated-polyurethane resin system derived from the hydroxyl-terminated polyperfluoropropylene oxide and 6-chloro-2,4,5-trifluoro-m-phenylene diisocyanate. Various new curing agents for this system were investigated, with the goal of providing a more thermally stable

crosslink (cure) mechanism to provide wider applicability and fuller utilization of the outstanding oxygen resistance of the PFPO system. Complete resistance to liquid- and gaseous-oxygen impact at presures as high as 1035 N/sq cm were attained with the use of the PFPO resin castings. The second corollary phase was directed toward investigating the feasibility and optimization of the allophanate cured, urethane extended polymer derived from hydroxyl-terminated polyperfluoropropyleneoxide and 6-chloro-2,4,5-trifluoro-m-phenylene diisocyanate, as the adhesive system for use in a weld-bond configuration for liquid oxygen tankage. The synthesis and application procedures of the adhesive system to insure liquid oxygen compatibility (under 10 kg-m loading), and the development of procedures and techniques to provide high quality weld-bonded joint configurations were studied. Author

N74-11923# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
FRAME: AN ON-LINE CORRECTION PROCEDURE FOR QUANTITATIVE ELECTRON PROBE MICROANALYSIS Final Report
H. Yakowitz, R. L. Myklebust, and K. F. J. Heinrich Oct. 1973 81 p refs
(NBS-TN-796) Avail: SOD HC $0.80 as C13.46:796

A procedure using a mini-computer for on-line correction of X-ray data from electron microprobe analysis was developed. This program, FRAME, allows mass fractions to be computed on-line by the ZAF approach. Other than X-ray intensities, the only input data required are the atomic numbers of the elements present, the analytical line being used, and the operating voltage. Other required parameters such as atomic weights and X-ray mass attenuation coefficients are stored or calculated by the program. FRAME is in FORTRAN 4, and requires about 4K of computer core. Results from FRAME are very close to those of COR2. Author

N74-11924# Chalmers Univ. of Technology, Goteborg (Sweden).
RADIO DETECTION OF INTERSTELLAR CH, PART 1
O. E. H. Rydbeck, J. Ellder, and W. M. Irvine 6 Nov. 1973 26 p refs
(RR-119-Pt-1) Avail: NTIS HC $3.50 CSCL 03B

The CH transitions in interstellar space are classified. Hyperfine splitting of CH and OH ions is considered, along with rough line intensity ratios. Energy levels and properties of CH emission are also presented. J.A.M.

N74-11925# National Research Council of Canada, Ottawa (Ontario).
COOPERATIVE ROTATIONAL ISOMERISM IN POLYMERS. 1: MELTING THEORY AND KINK CONCENTRATIONS
W. Pechold and S. Blasenbrey 1973 23 p refs Transl. into ENGLISH from Kolloid-Z. (Darmstadt), 1967 12 p
(NRC-TT-1698) Avail: NTIS HC $3.25

The bundle representation of almost parallel chains serves as a molecular model in which all the kink types used are realizable and in which the interaction energy of neighboring chains can be fully detected. This representation ensures optimal filling of the space while taking into consideration the deformation potentials of the single molecules and easily transforms to the chain crystal in the case of crystallization. The melt would be a paracrystal of very high kink density, an ordered state to which the X-ray halo probably corresponds and which is also in agreement with the Kargin experiments. Author

N74-11926*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ULTRAVIOLET AND THERMALLY STABLE POLYMER COMPOSITIONS Patent Application
Ronald F. Reinisch, Hermilo R. Gloria, Ronald E. Goldsberry, and Michael J. Adamson, inventors (to NASA) Filed 8 Nov. 1973 19 p
(NASA-Case-ARC-10592-2; US-Patent-Appl-SN-414043) Avail: NTIS HC $3.00 CSCL 07D

Aromatic azines for the preparation of poly(diarylsiloxy) arylazines are reported. These polymers are made by condensing a multihydroxylated aryl azine monomer of the invention with a bis(anilino)diaryl or dialkyl silane monomer. Because of their particular chemical composition, the resulting polymers have an inherent stability with respect to ultraviolet light and high temperatures. The stabilization occurs at wavelengths including those shorter than those found on earth, both in the absence and presence of oxygen, so that the polymers are particularly useful for application in extraterrestrial space. NASA

N74-11927# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF DECONVOLUTION TO THE TREATMENT OF HIGH RESOLUTION SPECTRA
Denis Bargues and Jean Laurent 1972 7 p refs In FRENCH; ENGLISH summary Presented at Conf. on the Study of the Treatment of Images, Paris, 13-15 Dec. 1972; Sponsored by CNES
(ONERA-TP-1187) Avail: NTIS HC $3.00

The deconvolution method, was used to improve the resolution of spectra recorded with a grille spectrometer. The results obtained on the SQ band of an NH3 spectrum are compared with those previously obtained by Stark effect. Author

N74-11928# Bundesminister fuer Verteidigung, Bonn (West Germany). Forschungsbericht aus der Wehrtechnik.
STUDIES ON THE REMOVAL OF CONDENSABLE ORGANIC MATTER FROM GASES BY LIQUID AIR [UNTERSUCHUNGEN ZUR BESEITIGUNG VON KONDENSIERBAREN ORGANISCHEN BESTANDTEILEN AUS GASEN DURCH ANWENDUNG VON FLUESSIGER LUFT]
U. Pfeiffer 1973 20 p GERMAN; ENGLISH summary
Avail: NTIS HC $3.00

Two different methods are used for measuring the removal of condensable organic matter from air by means of liquid air. One method is sensitive specifically for gases and vapors, the other for aerosols. After discussion of the experimental results technical details for improving the measuring techniques are proposed. Author

N74-11929# Kanner (Leo) Associates, Redwood City, Calif.
THE EFFECT OF HYDROGEN CHLORIDE ON PLANTS IN AN EXPERIMENT
E. Ewert Jan. 1973 12 p refs Transl. into ENGLISH from the publ. "Reports of the 6th International Conference of Forest Fume Damage Experts, 9-14 Sept. 1968 p 197-208 Sponsored by Environ. Protection Agency
(TR-327-73; APTIC-32323) Avail: NTIS HC $3.00

As substantial vegetation damage in immission regions of the chemical and potash industries were being experienced, the harmful effects of HCl on test plants were investigated experimentally. A test setup for plants under the action of phytotoxic compounds and an apparatus for producing desired concentrations of HCl-air mixtures are described. Agricultural and forest plants were subjected to a test gas mixture with HCl concentrations of 0.05 - 2.0 mg HCl/cu m, for up to 470 hr. Visible damage appeared primarily on the tips and edges of leaves and needles, in the form of brown necroses. Damage was absent under intermittent gas exposure only if the maximum immission concentration was below 0.05 mg HCl/cu m. The tested plant species were classified in three groups, corresponding to their sensitivity to HCl. Author

N74-11930# Kanner (Leo) Associates, Redwood City, Calif.
ACTIVATION ANALYSIS OF VANADIUM IN DEPOSITS AND AIRBORNE PARTICULATES
Shoji Bando and Tsuyoshi Imahashi Jan. 1973 14 p refs Transl. into ENGLISH from Bunseki Kagaku (Tokyo), v. 18, Dec. 1969 p 1477-1482 Sponsored by Environ. Protection Agency
(TR-293-72; APTIC-43447) Avail: NTIS HC $3.00

Trace amounts of vanadium in dust fall deposits and in airborne particulates were determined by the method of neutron activation analysis. The collected samples were subjected to neutron irradiation for 2 min. and were fused with sodium hydroxide. Then the vanadium was extracted from the pH 4 solution by means of chloroform as a 2-methyl-oxine complex. The extract was then subjected to gamma ray spectrometry, the absorbance was measured, and the vanadium was estimated by seeking the chemical yield by photometry. The average chemical yield was 95%; and the time required for analysis was about 10 min. Vanadium in dust fall deposits and in airborne particu-

lates can be estimated rapidly by this method to quantities of 0.003 micrograms. Author

N74-11931# Scientific Translation Service, Santa Barbara, Calif.
COLORIMETERIC DETERMINATION OF SULPHUR DIOXIDE IN COMBUSTION PRODUCTS
Vera Hraseova and Jan Vogel [1973] 9 p refs Transl. into ENGLISH from Energetika (Kharkov), v. 16, no. 7, 1966 p 344-346 Sponsored by APTIC
(TR-238-73) Avail: NTIS HC &3.00

The outlined colorimetric method for determination of SO3 in smoke gases shows adequate sensitivity and more speed and reliability than any previous method. An advantage of this method is in the use of recordings, stability of solutions and simple and precise plots of calibration curves. Equally important is the fact that random substances in smoke gases do not interfere with the actual test and the correct determination. Relatively inexpensive instrumentation and method simplicity are well suited for field use. Author

N74-11932# Kanner (Leo) Associates, Redwood City, Calif.
STATE AND DEVELOPMENT OF TRACE GAS MEASUREMENT
Wolfram Breuer Dec. 1972 10 p Transl. into ENGLISH from Chem-Ing.-Tech. (West Berlin), v. 44, no. 10, 1972 p 653-655 Sponsored by Environ. Protection agency
(TR-297-73; APTIC-42303) Avail: NTIS HC $3.00

A state of the art review is presented of the measurement technology required in determining the concentration of air pollutants in the atmosphere. An immission measurement program conducted in West Germany is described along with the instrumentation developed for its successful operation. D.L.G.

N74-11933# Kanner (Leo) Associates, Redwood City, Calif.
USE OF GAS CHROMATOGRAPHY FOR ENVIRONMENTAL ANALYSIS OF OFFENSIVE ODORS
Tatsuo Kato Jan. 1973 26 p refs Transl. into ENGLISH from Anzen Kogaku (Japan), v. 10, no. 2, 1971 p 97-104 Sponsored by Environ. Protection Agency
(TR-289-73; APTIC-42403) Avail: NTIS HC $3.25

The analytical method of analyzing air pollution in the atmosphere is presented. In particular, a high-concentration apparatus for GC samples was designed, which was based on the adsorption effect on the surface of fire brick cooled with liquid oxygen. One hundred liters of air sample could be concentrated to a few ml with 100% efficiency in less than ten minutes. Components with boiling points from minus 100 C to plus 200 C were analyzed quantitatively, and with FID detecting, the analytical limit was 10 to the minus 12 power (ppt). Practically, this method was used to analyze odor pollution in the field, such as kraft pulp, petrochemical combinations, and fish meal plants, and, according to the results obtained during the past three years, could be proposed as a standard method. Author

N74-11934# Kanner (Leo) Associates, Redwood City, Calif.
AEROSOL SEDIMENTATION MECHANISMS IN WATER VAPOR DIFFUSION FIELDS
A. N. Terebenin and A. P. Bykov Dec. 1972 10 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow), v. 45, no. 5, May 1972 p 1012-1015 Sponsored by Environ. Protection Agency
(TR-288-73; APTIC-45713) Avail: NTIS $3.00

When the gas flow which is saturated with water vapor is cooled in the vertical plane parallel channel, the aerosol particles in the mixture are enlarged through condensation, and the drops which are formed settle largely due to the action of diffusion forces. Highly dispersed aerosol particles can settle from the flux under the described conditions. Author

N74-11935# Kanner (Leo) Associates, Redwood City, Calif.
ANALYSIS OF ZINC AND LEAD IN SUSPENDED PARTICULATES BY FLUORESCENT X-RAY SPECTROMETRY
Hidekatsu Mitsugi, Nobuhiro Takata, Manoyuki Motoyama, Makoto Akamatsu, and Genzo Hashizume Jan. 1973 17 p refs Transl. into ENGLISH from Bunseki Kagaku (Tokyo), v. 19, Oct. 1970 p 1383-1388 Sponsored by Environ. Protection Agency
(TR 291-73; APTIC-43448) Avail: NTIS HC $3.00

Nondestructive determination of zinc and lead in suspended particulates was investigated by using filter paper and briquette methods. To prepare the standard samples, ZnO, PbO2 or Pb(NO3)2 were diluted to a given concentration with kaolin which was regarded as a typical constituent of suspended particulates. Fe2O3 and CaSO4.2H2O were added to the standard samples for checking up the matrix effect. The calibration curves were obtained by using scattered X-rays from W-tube as an internal standard to correct the matrix effect. The quantitative ranges were above 1 microgram from Pb by the filter paper method and above 0.5 microgram/g from Zn and 5 microgram/g for Pb by the briquette method, respectively. Analytical results of Zn and Pb in suspended particulates by this procedure agreed with those by atomic absorption method. Author

N74-11936# Mundus Systems Inc., Washington, D.C.
THE DETERMINATION OF HEAVY METALS IN DUSTFALL BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
N. Sugawara and J. Yamazaki [1973] 12 p refs Transl. into ENGLISH from J. Japan Soc. Air Pollution (Japan), v. 4, no. 2, Nov. 1970 p 182-187 Sponsored by EPA
(TR-105-73; APTIC-25535) Avail: NTIS HC $3.00 CSCL 07D

The elements of iron, copper, lead, and zinc in ash are determined by spectrophotometry. For this purpose, extraction or addition of organic solvent or dilution is used. It is known that analysis sensitivity is increased by the use of organic solvent. Among these methods, reasonable results were achieved in diluting ashes with three kinds of acid (nitric acid, hydrochloric acid and perchloric acid), and their mixtures (a mixture of nitric acid and perchloric acid, a mixture of nitric acid and hydrochloric acid, and a mixture of hydrochloric acid and perchloric acid). Treatment with hydrochloric acid seems to give the best results. Author

N74-11937# Defence Standards Labs., Maribyrnong (Australia).
HIGH TEMPERATURE MASS SPECTROMETRY USING KNUDSEN CELL VAPORIZATION
G. R. Johnston Sep. 1973 23 p refs
(Rept-571) Avail: NTIS HC $3.25

In this review of high temperature mass spectrometry (HTMS), particular emphasis has been placed on Knudsen cell vaporization systems. Experimental techniques are discussed, together with some of the aspects of mass spectrometry pertinent to HTMS systems. This is followed by a general account of the information which can be obtained from such systems, and finally a number of specific examples of the application of HTMS, particularly in the field of metallurgy, are given. Author

N74-11938# Scientific Translation Service, Santa Barbara, Calif.
CONTRIBUTION TO THE ANALYTICAL DETERMINATION OF THE NITROGEN OXIDES NO AND NO2
P. Bourbon, J. Alary, J. Esclassan, and F. Alengrin 1973 30 p refs Transl. into ENGLISH from Tribune CEBEDEAU (Centre Belge Etude Doc. Eaux) (Liege), no. 337, 1971 p 1-9 Sponsored by Environ. Protection Agency
(APTIC-37777; TR-551-A-73) Avail: NTIS HC $3.50

Most measurements of NO2 use a diazotization reaction, with NO being determined after oxidation of NO2. As a result of various experiments it is shown that an increase in the amine concentration in the reagent used results in an important increase in method efficiency. A comparative study of the tranformation of NO into NO2 by different oxidizing reagents considers KMnO4 in sulfuric acid, and Na2Cr2O7 in sulfuric acid on glass fiber filters. G.G.

N74-11939# Argonne National Lab., Ill.
EIGHTEENTH ANNUAL CONFERENCE ON BIOASSAY, ENVIRONMENTAL, AND ANALYTICAL CHEMISTRY: PROGRAM AND ABSTRACTS
1972 39 p Conf. held at Oak Brook Terrace, Ill., 10-11 Oct. 1972
(Contract W-31-109-eng-38)
(ANL-8014; Conf-721096) Avail: NTIS HC $4.00

Abstracts of 25 papers presented at the 18th Annual Conference on bioassay, environmental, and analytical chemistry are presented. NSA

N74-11940# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
CHEMISTRY RESEARCH AND DEVELOPMENT Research and Ecology Semiannual Progress Report, Jul. - Dec. 1972
William C. Bright, Dana R. Cartwright, Jerry D. Moseley, and Edward Vejvoda 16 May 1973 32 p refs
(Contract AT(29-1)-1106)
(RFP-2004-A) Avail: NTIS HC $4.00

Short summaries are presented of work in progress in the areas of fabrication of Pu-244 metal foil; recovery, storage, and chemistry of plutonium; radioactive waste processing; and radiation monitoring. NSA

N74-11941# National Academy of Sciences - National Research Council, Washington, D.C.
SUBSTITUTE CATALYSTS FOR PLATINUM IN AUTOMOBILE EMISSION CONTROL DEVICES AND PETROLEUM REFINING Final Report
Mar. 1973 110 p
(Contract GS-00-DS-(P)-94008)
(PB-222167/9; NMAB-297) Avail: NTIS HC $5.45 CSCL 07A

The technological potential is reported of catalysts other than platinum as economic and efficient substitutes for platinum in petroleum refining and automobile emission devices for control of atmospheric pollution. Much research is being done to develop base-metal catalysts but at present they are only one percent as active as platinum per unit amount of metal under practical conditions in an exhaust environment. More research is necessary in many areas, especially hydrocarbon and carbon monoxide oxidation by oxides and salts with promise of high thermal stability, and nitrogen oxide removal by base metals and their alloys. The report should be read in the context of newer information that will be released. Author (GRA)

N74-11942# Aerospace Corp., El Segundo, Calif.
KINETICS AND MECHANISMS OF ULTRAVIOLET EMISSION Technical Report, Jan. - Feb. 1973
John H. Birely 31 Jul. 1973 27 p refs
(Contract F04701-73-C-0074)
(AD-766413; TR-0074(4642)-1; SAMSO-TR-73-267) Avail: NTIS CSCL 07/4

Mechanisms for production of near-ultraviolet (UV) and vacuum-ultraviolet (VUV) radiation in reactions of oxygen with C2H2, C2H4, C2H4, C3O2, C2F4, N2H4, and several other simple molecules are reviewed. In the absence of atomic nitrogen, CO fourth-positive (4-) radiation appears to be produced by the direct chemiluminescent reaction of oxygen atoms with the C2O radical. In the presence of nitrogen atoms, energy transfer and energy pooling mechanisms become important channels for the production of bands in the CO (4-) and Cameron, the N2 Lyman-Birge-Hopfield, and the NO gamma and beta systems. Other mechanisms for production of CO, N2, NO, and OH emissions are discussed, and potential areas for future experiments are noted. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N74-11943 Stanford Univ., Calif.
SIDE-LOBE CONTROL IN ANTENNAS FOR AN EFFICIENT USE OF THE GEOSTATIONARY ORBIT Ph.D. Thesis
Joano Carlos Fagundes Albernaz 1973 155 p
Avail: Univ. Microfilms Order No. 73-14857

The antenna subsystem in the utilization of the geostationary orbit by communication satellites is studied, and ways of achieving side-lobe radiation control in parabolic reflector antennas are proposed. The results have shown that, in an interference-limited environment, by the introduction of antennas with controlled side-lobe radiation, the interference potential between adjacent systems using the same frequency band can be lessened. It is suggested that the standardization in the antennas to be used in conjunction with satellite links must be formulated not with the antenna diameter as the prime parameter but rather by considering the antenna interference rejection performance specifications. Dissert. Abstr.

N74-11944 Illinois Univ., Urbana.
AN INVESTIGATION OF DIRECTIONAL PROPAGATION EFFECTS IN HIGH-FREQUENCY RADIO SOURCE LOCATION Ph.D. Thesis
Roy Ian Beckwith 1972 243 p
Avail: Univ. Microfilms Order No. 73-17113

The prediction of horizontal ray path deviation effects in high frequency ionospheric propgation arising from large-scale temporal and geographical variations in the ionospheric structure is investigated. A technique for the rapid calculation of these predicted path deviation effects is presented. This technique involves the use of an ionospheric prediction model in conjunction with a procedure for determining the ray path geometry in three dimensions; it may be applied to both single hop and multiple hop high frequency propagation paths. The main features and limitations of this three dimensional predictive propagation model are discussed and examples are presented illustrating the use of this model in high frequency radio source location applications. Dissert. Abstr.

N74-11945 Northeastern Univ., Boston, Mass.
THE CHARACTERIZATION OF MULTIPATH AND DOPPLER FADING IN EARTH SCATTER COMMUNICATION, NAVIGATION, AND RADAR LINKS Ph.D. Thesis
Joseph Kenneth DeRosa 1972 207 p
Avail: Univ. Microfilms Order No. 73-18385

The multipath and Doppler-spread characteristics are described for a wide class of communication and radar systems in terms of the statistical and electrical properties of the scattering surface, the geometry of the link, and the properties of the receiving and transmitting antennas. Specifically, the earth scatter portion of the channel is analyzed from both the phenomenological (input-output) point of view of the communication theorist and the physical point of view of the propagation physicist. The scattering surface is modeled as a two-dimensional spatial stochastic process with two discernible scales of roughness and an arbitrary complex dielectric constant. The channel correlation function known as the delay-Doppler scattering function is derived from the solutions of the propagation equations describing the scattering process. The scattering cross section of the surface is presented. Dissert. Abstr.

N74-11946 British Broadcasting Corp., Kingswood (England). Research Dept.
FREQUENCY-DEPENDENT LIMITERS FOR FM SOUND TRANSMITTERS
W. I. Manson Oct. 1973 9 p refs
(BBC-RD-1973/25) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Sound signals applied to FM transmitters are normally subjected to high-frequency pre-emphasis. If no form of overload protection is included in the system the transmitters can be overmodulated by high level, high frequency audio components, even with program signals correctly controlled at the studio. In an effort to reduce this effect alternative forms of limiter have been studied in which the program signals are controlled frequency selectively, rather than attenuated uniformly. Two basic techniques have been examined. In one, limiter control is exercised in discrete bands within the audio-frequency range; in the other, the amount of control is increased progressively with frequency-in the limit simply offsetting the effect of the pre-emphasis to which the signal has been subjected. Author

N74-11947 British Broadcasting Corp., Kingswood (England). Research Dept.
RADIO MICROPHONES: OPERATION AT LOW FREQUENCIES
R. D. C. Thoday Oct. 1973 7 p ref
(BBC-RD-1973/26) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The use of low frequencies for radio microphones and talk back systems in television studio is considered. Mutual interference

with other apparatus in the studio, particularly with television cameras, rules out the possibility of using these frequencies. The risk of interference from numerous external sources would exist also. Author

N74-11948 British Broadcasting Corp., Kingswood (England). Research Dept.
MF PROPAGATION: POLARISATION COUPLING LOSS WITH HORIZONTAL TRANSMITTING AERIALS
P. Knight Oct. 1973 8 p refs
(BBC-RD-1973/27) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

An expression is derived for the polarization coupling loss which arises at medium frequencies when a transmitted wave of arbitrary polarization is incident on the ionosphere. The result is applied to the calculation of coupling losses for horizontal aerials over imperfectly conducting ground; in general such aerials radiate elliptical polarization. Coupling losses computed for a typical horizontal aerial are given as an example. Author

N74-11949 Stanford Univ., Calif.
MINIMUM-COST SATELLITE TELECONFERENCING NETWORKS Ph.D. Thesis
James Gordon Potter 1973 161 p
Avail: Univ. Microfilms Order No. 73-14959

Algorithms are developed for performing the tradeoffs that are involved in minimizing the cost of a satellite teleconferencing network. The optimization procedures are subject to constraints on spectrum utilization, required coverage, number of wideband and narrowband channels to be distributed, and the required signal quality for all categories of information to be distributed. Two interesting implications of the numerical results are that: 1. The economics of satellite teleconferencing appear to be compelling (in the sense that communications costs could be low), and 2. The case for modest-antenna-diameter-slave stations is persuasive, but that for extremely high-EIRP satellite transponders is not. Satellite technology appears to have advanced sufficiently to permit economical teleconferencing among small users in the near future. Dissert. Abstr.

N74-11950 British Broadcasting Corp., Kingswood (England). Research Dept.
A REVIEW OF EQUALISATION TECHNIQUES FOR ANALOGUE TELEVISION SIGNALS
D. J. Whythe Nov. 1973 i2 p refs
(BBC-RD-1973/28; PH-111) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Automtic equalizers are considered in relation to their suitability for inclusion in the existing national television network. Both time domain and frequency domain equalizers are discussed and it is concluded that improved average overall performance would most probably result if automatic frequency domain equalizers were added at suitable points in the network in order to correct both the residual distortions of the links and their variations with time. Author

N74-11951 British Broadcasting Corp., Kingswood (England). Research Dept.
DIGITAL TELEVISION RECORDING: A REVIEW OF CURRENT DEVELOPMENTS
A. H. Jones Nov. 1973 14 p refs
(BBC-RD-1973/29) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Current developments in high density digital recording are examined in the light of present and probable future requirements of broadcast television recording. Consideration is given to the techniques most likely to feature in future digital television recorders and it is concluded that operational machines could be made using magnetic heads and tape but that the long-term solution may well be provided by one of the newer technologies using laser beams. Author

N74-11952 British Library Lending Div., Boston Spa (England).
SUBJECTIVE DEFINITION OF THE MAIN PARAMETERS OF A LINEAR PCM VIDEO SYSTEM
F. Alberico, G. F. Barbieri, P. DAmato, and I. Ghidini 3 Sep. 1973 19 p refs Transl. into ENGLISH from Elettronica e Telecomun. (Italy), no. 3, 1972 p 95-101
(BLL-PO-2960-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The main parameters of a linear PCM video system are considered. Sampling frequency, number of bits per sample, and dither. After a general discussion concerning the influence of these parameters on the co-decoded signal quality, the results of subjective tests are reported. Author

N74-11953 British Library Lending Div., Boston Spa (England).
LINEAR DIGITAL CODING OF VIDEO SIGNALS (LINEAR VIDEO PCM)
G. P. Barbieri, M. Cominetti, and P. DAmato 3 Sep. 1973 8 p refs Transl. into ENGLISH from Electronica e Telecomun. (Italy), no. 3, 1972 p 92-94
(BLL-PO-2959-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The general principles of a PCM linear system are outlined and applications of such a system in commercial television, particularly for program generation, are discussed. Author

N74-11954# Advisory Group for Aerospace Research and Development, Paris (France).
DETERMINATION AND USE OF RADAR SCATTERING CHARACTERISTICS
Sep. 1973 171 p refs Conf. held at Bolkesjoe, Norway, 11-12 Oct. 1973; London, 15-16 Oct. 1973; The Hague, 18-19 Oct. 1973
(AGARD-LS-59) Avail: NTIS HC $10.75

Radar echoes and radar cross sections are reviewed for different classes of targets; main parameters affecting backscatter signal are analyzed. For individual titles, see N74-11955 through N74-11967.

N74-11955 EMI Electronics Ltd., Wells (England).
INTRODUCTORY LECTURE: TARGET SCATTERING CHARACTERISTICS OF IMPORTANCE TO RADARS
L. R. Cram *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 4 p (For availability see N74-11954 03-07)

Scattering characteristics of interest include the Doppler content, the range noise and the angular glint as well as the radar cross section (RCS), or radar echoing area (REA). A definition is given of these parameters (RCS or REA) and the physical reasons for variations around a target are discussed. Both amplitude and rate of change significantly affect radar performance. Reciprocally, the value of the radar echoing area can itself be affected by the radar parameters such as modulation type, frequency and polarization. Target glint will affect the accuracy of directional information provided by the radar. The rates of change and frequencies of change of glint are also important. Radar parameters and the glint data interact with each other in that polarization characteristics of the radar affect the glint and its frequencies while the significance of glint frequencies depends on radar servo rates, etc. Targets which are of interest include land, sea and airborne vehicles. Sea and land reflections represent either clutter or targets in their own right. Birds represent hazards to aircraft so their radar scattering is also of interest. Author

N74-11956 Ohio State Univ., Columbus. ElectroScience Lab.
COMPUTATIONAL AND ANALYTICAL DETERMINATION OF RCS
Edward M. Kennaugh *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 9 p refs (For availability see N74-11954 03-07)

Improvements in computational techniques for calculation of RCS now permit wider ranges of objects to be analyzed. The lecture reviews the state of the art at present, with a description of two basic approaches. The point matching or wire grid model utilizes a matrix description of a three dimensional shape and proceeds to calculate RCS through solution of a large order system of linear equations. The asymptotic or quasi optical solution identifies key contributions to RCS which may be given simple mathematical description and summed automatically, with proper account of phasing, as a function of attitude. The limitations and virtues of each method are described, and the possibility of

combining both computational methods is explored. Illustrative examples are presented, and the importance of this tool as an adjunct to experimental RCS studies is discussed. Author

N74-11957 Test Group (6585th), Holloman AFB, N.Mex. Radar Target Scatter Facility.
STATIC PULL SCALE MEASUREMENTS OF RCS
Carroll R. Griffin, Jr. *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 11 p (For availability see N74-11954 03-07)

A number of techniques for the measurement of radar cross section are discussed and compared. A description of the theory of operations of a ground plane range is provided. Some considerations for use, and some of the advantages of the ground plane method result from the theory. A description of the equipment and methods for obtaining RCS data is followed by a description of special measurement systems available. Finally, a brief description of the functional organization required in the operation of an RCS measurement site is provided. Author

N74-11958 Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Observables Group.
DYNAMIC FULL SCALE MEASUREMENT OF RCS
William F. Bahret *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 16 p refs (For availability see N74-11954 03-07)

Trade-offs and technical considerations in dynamic measurements of radar cross section are discussed to establish requirements for instrumentation and techniques used for such measurements. Primary emphasis is given to aircraft targets although most of the discussion applies to sea or land based targets as well. Block diagrams of practical systems for measuring amplitude and angular scintillation are presented and discussed. Typical output data are related to the primary user requirements. Author

N74-11959 EMI Electronics Ltd., Wells (England).
MODELLING METHODS OF DETERMINING RADAR ECHO CHARACTERISTICS
L. A. Cram *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 7 p (For availability see N74-11954 03-07)

Optical modelling is now rarely used but ultrasonic modelling is far more effective. A well instrumented facility for ultrasonic modelling is described which operates in water with wavelength scaling from 1/10 to 1/40. Speedy operation and good range discrimination are particularly advantageous. Radio scale modelling has additional advantages and a radio scale modelling facility incorporating five different measuring equipments is described. Mutual interference is avoided by range gating the radars. Scaling is from 1/1 to 1/100 and many different radars operate from 1 GHz to 100 GHz. Targets of metal coated wood are suspended by nylon strings. Two general purpose equipments permit flexible choice of radar system, aerial type, wavelength and polarization. Other systems are specialized for investigating the end course of a missile radar, the reflections from sea waves and the effects of target glint on radar aiming errors. A radar system assessment team with computers completes the radio modelling facility. Author

N74-11960 EMI Electronics Ltd., Wells (England).
TARGET CHARACTERISTICS
S. C. Woolcock *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 18 p refs (For availability see N74-11954 03-07)

A knowledge of the radar scattering properties of complex targets is a necessary requirement for the detailed study of modern radar systems. The use of computers for such studies requires that these properties shall be described in compact form. By making radar measurements of high quality scaled models a better understanding of target reflectivity is being achieved. The dependence of the received signal on the frequency and polarization of the incident field as well as on the characteristics of the radar system is described. Reflections from simple shapes are discussed to show how the radar cross section can be computed by geometric optics, physical optics and by consideration of travelling wave echoes. The sources of radar reflection for an aircraft and for a missile shape are next discussed. These were determined by measurement. There follows an introduction to the concept of angular glint. Glint properties of a complex target are described and associated with the perturbations on phase fronts. Features of glint are highlighted, in particular the wander of the mean glint centre with the target outline. Finally an example is shown of Doppler spectra obtained from an aircraft. Spectral lines associated with moving parts are usually present. In this instance several frequency components have arisen which can be associated with the rotating turbines of engines. Author

N74-11961 Royal Radar Establishment, Malvern (England).
RADAR ECHOING AREAS OF FLYING ANIMALS
E. W. Houston *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 11 p refs (For availability see N74-11954 03-07)

The echo signal from a flying animal consists of at least two components: an average or mean component and an amplitude modulated component. The mean component is proportional to the slow variations in echoing area, resulting from long term variations of the animal's aspect as it flies past the radar. The modulation component follows the rapid variations generated by wing flapping or by transient fluctuations in echoing area produced, for example, by head movements. The periodic wingbeat modulation of the echo signal from even a small bird is distinctive and makes it easy to separate this form of target out from echoes. By selective measurements on flying animals under laboratory conditions the task of specifying radar echoing areas can be reduced when these static cross sections are compared with dynamic echoing areas measured on animals in flight. Author

N74-11962 Royal Radar Establishment, Malvern (England).
RADAR SEA CLUTTER
Geoffrey Bishop *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 21 p (For availability see N74-11954 03-07)

Radar sea clutter studies have been made based on a series of trails, in which X-band non-coherent radar measurements have been taken from a cliff top site in Cornwall, England. Horizontal, vertical and circular polarizations were transmitted using pulse lengths of 70 nanosec and 270 nanosec with an antenna beamwidth of 0.6. Horizontal, vertical or both hands of circular polarization were received. Amplitude distribution curves show the effects of change in sea state, polarization and pulse length on the cross sectional echoing area characteristics of sea clutter and moored buoy targets. Cross polarization effects have been studied. Autocorrelation analyses of the recorded radar returns show clutter decorrelation times varying from 5 milliseconds to several seconds. Author

N74-11963 Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
THE USE OF TARGET AND CLUTTER DATA FOR DIFFERENT METHODS OF DISCRIMINATION BETWEEN TARGETS AND UNWANTED CLUTTER
Karl VonSchlachta *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 21 p refs (For availability see N74-11954 03-07)

The signal processing procedures adopted in surveillance radars for discriminating target and clutter are based on results of statistical decision theory. The practical implementation is discussed with reference to two groups of radar and the influence of target and clutter characteristics are pointed out. A first group comprises the processing of incoherent video signals. The examples are the sequential detection device, the Scan to Scan MTI and procedures for fast switching between normal and MTI video signal. A second group deals with the processing of coherent radar signals. The Doppler information of moving targets is used for the discrimination between targets and unwanted clutter. A modern device applying the likelihood ratio test and using Doppler filters in the time domain is described. Further investigations are made for suppression of moving clutter by adaptive filtering. Author

N74-11964 Test Group (6585th), Holloman AFB, N.Mex. Radar Target Scatter Facility.
PRESENTATION AND STORAGE OF RADAR CROSS-SECTION DATA

Carroll R. Griffin, Jr. *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 24 p (For availability see N74-11954 03-07)

The data required to be taken in conjunction with the measurement of radar cross sections are divided into two categories: that associated with the target orientation or aspect, and that associated with the radar measurement parameters. Several types of presentation are used, and various types of records of the data are available, both analog and digital. The standardization of data formats and conventions for target orientations are important objectives which should be established for the benefit of users of RCS data. Author

N74-11965 EMI Electronics Ltd., Wells (England).
USE OF RADIO MODELLING DATA
S. C. Woolcock *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 13 p refs (For availability see N74-11954 03-07)

The U.K. radio modelling facility has permitted the amassing of much data concerning reflections from a wide variety of radar reflecting objects at many different frequencies and at all possible polarization configurations. The data must be reduced by a method which does not remove details of the scattering signal to which the radar system is sensitive. Three methods are in use: (1) Statistical summaries such as cumulative probability, spectral distribution, autocorrelation function or mean value and standard deviation; (2) look-up table (no data reduction) using computer storage data on echo characteristics of targets; and (3) multiple source mathematical models that represent a target by a number of elementary sources, each of defined strength, polar diagram and position. A radar analysis example is given where a simple computer program determines the performance of a sequential lobing radar in locating a shell whose polar echo characteristics are fed directly from a recording of the radio range data. Author

N74-11966 Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Observables Group.
THE USE OF RCS DATA
William F. Bahret *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 10 p refs (For availability see N74-11954 03-07)

Data requirements and limitations are emphasized that are associated with systems analysis involving radar cross section, rather than the mechanics of any actual analysis. Treated separately as increasingly sophisticated levels of target characterization are far zone, near zone, and glint data. Typical applications and practical requirements for these applications are discussed to define adequate methods for obtaining and presenting RCS data. The general theme is that applying RCS data is rather straightforward provided that truly pertinent and accurate data are available in suitable form. On the other hand, to settle for less in the way of RCS data is to gamble an expensive system design to save the relatively small investment for obtaining proper data. Author

N74-11967 EMI Electronics Ltd., Wells (England)
STATE OF THE ART AND FUTURE PROSPECTS
L. A. Cram *In* AGARD Determination and Use of Radar Scattering Characteristics Sep. 1973 7 p (For availability see N74-11954 03-07)

The state of the art regarding radar scattering characteristics and their acquisition and use is summarized. It is indicated how a choice may be made among the various methods for finding and for using radar cross section data to assess radar performance. Those are many methods of collecting radar data. Each has its different disadvantages but when the various methods are used with care and within their limitations they give consistent and comparable results with one another. Hence bearing in mind the appreciable costs it is important to choose an optimum use of the various methods. This optimum will often mean some use of all of the techniques. Each radar systems investigation must be examined to determine the particular optimum procedure for finding the echo data needed for that study. Author

N74-11968*# Kanner (Leo) Associates, Redwood City, Calif.
LIMITS OF SUITABILITY OF PSEUDORANDOM SIGNALS FOR STATISTICAL TESTS
A. Gaugg, M. Seidel, and H. Weinrichter Washington NASA Nov. 1973 20 p refs Transl. into ENGLISH from Arch. Elektron. Uebertragungstech., v. 27, Jan. 1973 p 30-36
(Contract NASw-2481)
(NASA-TT-F-15188) Avail: NTIS HC $3.00 CSCL 20N

Typical dependences are shown in the pattern of m-sequences of the length two to the nth power-1 which take effect in particular with linear filtering. For k smaller than n, filtering in the form of a summation of k consecutive bits results in no essential differences with respect to comparable genuine random signals as far as amplitude distribution and frequency of transition are concerned. For k equals n, the frequencies of transition exhibit typical differences, depending on the principle of m-sequence generation. For k larger than n, strong asymmetries in the amplitude distribution result as well. This leads to the conclusion that, despite ideal correlation properties over the entire period duration, the individual bits of an m-sequence can only be considered as statistically independent within intervals of length n of the generating shift register. Author

N74-11969*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REFLECTION AND INTERFERENCE OF ELECTROMAGNETIC WAVES IN INHOMOGENEOUS MEDIA
F. E. Geiger and H. L. Kyle Sep. 1973 35 p refs Submitted for publication
(NASA-TM-X-70518; X-650-73-297) Avail: NTIS HC $3.75 CSCL 20N

Solutions were obtained of the wave equation for a plane horizontally polarized electro-magnetic wave incident on a semi-infinite two dimensional inhomogeneous medium. Two problems were considered: An inhomogeneous half space, and an inhomogeneous layer of arbitrary thickness. Solutions of the wave equation were obtained in terms of Hankel functions with complex arguments. Numerical calculations were made of the reflection coefficient R at the interface of the homogeneous medium. The startling results show that the reflection coefficient for a complex dielectric constant with gradient, can be less than that of the same medium with zero gradient. Author

N74-11970# Physics Lab. RVO-TNO, The Hague (Netherlands).
MODE MATCHING ANALYSIS OF AN INFINITE PLANAR PHASED-ARRAY
A. M. H. VanSpengen and H. J. VanSchaik Jul. 1973 49 p refs
(PHL-1973-31) Avail: NTIS HC $4.50

The behavior of an element in an infinite phased-array antenna of rectangular waveguides is investigated theoretically; in particular, the reflection factor is calculated. The electromagnetic fields are expanded in terms of waveguide modes in the waveguide region and in terms of space harmonics in the free space domain. By means of a mode matching technique, an infinite set of algebraic equations are obtained in which the expansion coefficients of the waveguide field occur as unknowns. The relevant system is solved numerically, employing a judicious truncation. Some numerical results are presented. Author

N74-11971*# Computer Sciences Corp., Falls Church, Va.
NASA COMPENDIUM OF SATELLITE COMMUNICATIONS PROGRAMS
Aug. 1971 483 p refs
(Contract NAS5-21522)
(NASA-CR-132879) Avail: NTIS HC $26.25 CSCL 17B

A comprehensive review of worldwide satellite communication programs is reported that ranges in time from the inception of satellite communications to mid-1971. Particular emphasis is placed on program results, including experiments conducted, communications system operational performance, and technology employed. Author

N74-11972# IIT Research Inst., Annapolis, Md.
RADIO FREQUENCY EMISSION CHARACTERISTICS AND MEASUREMENT PROCEDURES OF INCIDENTAL RADIATION DEVICES AND INDUSTRIAL, SCIENTIFIC AND MEDICAL EQUIPMENT Final Report
H. Martin and F. Tabor Sep. 1972 77 p refs
(Contract DOT-FA70WAI-175)

(ECAC-PR-72-043; FAA-RD-72-80-1) Avail: NTIS HC $6.00

Descriptive information and measured radio frequency radiation characteristics are reported for radio frequency dielectric heaters, garage door openers (superregenerative receivers), a superregenerative converter, a radio frequency diathermy machine, a radio frequency stabilized arc welder and an automobile ignition system. Procedures suitable for FAA use, for measuring the radiation characteristics of dielectric heaters and superregenerative receivers, are included. Author

N74-11973# IIT Research Inst., Annapolis, Md.
THE ELECTROMAGNETIC COMPATIBILITY OF AERONAUTICAL COMMUNICATION AND NAVIGATION SYSTEMS WITH RADIO FREQUENCY DIELECTRIC HEATERS AND SUPERREGENERATIVE RECEIVERS Final Report
Fred Tabor and Harry Martin Oct. 1972 130 p refs
(Contract DOT-FA70WAI-175; FAA Proj. 213-516-035)
(ECAC-PR-72-045; FAA-RD-72-80-2) Avail: NTIS

Degradation thresholds of interference from radio frequency dielectric heaters and superregenerative receivers to aircraft communication and navigation receivers were established. Degradation thresholds so established were employed to assess the degradation to the aeronautical communication and navigation services under operational conditions. The adequacy of the present regulatory limits governing the radiation from dielectric heaters and superregenerative receivers was examined from the standpoint of prevention of interference to the aeronautical services. Author

N74-11974*# Magnavox Co., Silver Spring, Md.
TELEMETRY CODING STUDY FOR THE INTERNATIONAL MAGNETOSPHERE EXPLORERS MOTHER-DAUGHTER AND HELIOCENTRIC MISSIONS. VOLUME 1: SUMMARY Final Report
David E. Cartier Aug. 1973 21 p refs
(Contract NAS5-20386)
(NASA-CR-132880; ASAO-PR20046-4-Vol-1) Avail: NTIS HC $3.25 CSCL 09F

The convolutional coding study on the IME Mother-Daughter and Heliocentric spacecraft is reported. The three major tasks involved in the study are summarized. D.L.G.

N74-11975# Australian Post Office Research Labs., Melbourne.
THE PERIPHERAL REGISTER FOR THE IST PROJECT
M. Chan May 1973 19 p refs
(Rept-6802) Avail: NTIS HC $3.00

The peripheral register for the I.S.T. project is an interface equipment interconnecting the I.T.T. 1600 processors and I.S.T. network. It allows information to be transferred between the processor and the network. As the network is situated at some distance from the processor, the AC bus but not the DC bus terminal is employed for transmitting information. The procedures for the transfer of information are always achieved by a compelled sequence of operations. The processor first outputs the command signal to the peripheral register, specifying the required function. It then proceeds to complete the operation provided a ready signal is returned from the peripheral register. When the ready signal is not received within a specific time interval, transfer of information will not take place and an appropriate action will be taken by the processor depending on the specification of the program. The I.T.T. 1600 processor can transfer a 16-bit word for a single output operation. If the output information consists of more than a 16-bit word, more than one output operation is required. Author

N74-11976# Joint Publications Research Service, Arlington, Va.
STATISTICAL METHODS IN SONAR
V. V. Olshevskiy 20 Nov. 1973 182 p refs Transl. into ENGLISH of the book "Statisticheskiye Metody v Gidrolokatsii" Leningrad, Izd. Sudostroyeniye, 1973 182 p
(JPRS-60586) Avail: NTIS HC $11.25

Methods of experimental research in sonar, models of emitted signals, echo signals, and reverberatory interference and statistical measurements are examined. Author

N74-11977# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
STUDY AND REALIZATION OF DISPERSIVE ACOUSTICAL DELAY LINES WITH INTRINSIC LOBE WEIGHTING Final Report [ETUDE ET REALISATION DE LIGNES A RETARD ACOUSTIQUES DISPERSIVES A PONDERATION INTRINSEQUE]
P. Hartemann 22 Feb. 1972 201 p refs In FRENCH
(Contract STTA-70/86/056)
(Rept-4.495) Avail: NTIS HC $12.25

Delay lines with dispersive acoustical properties for pulse radar emission and pulse compression are studied. Two types of lines were considered depending on the bandpass and the pulse duration. Both types were studied in two versions: linear or nonlinear. In the nonlinear case, the secondary lobes of the compared pulse are reduced by more than 24 db with respect to the main lobe without adjunction of a filter. Analytical expansions for transit time fluctuations, radiative impedance, and insertion losses are given. Time and phase sampling methods for the piezolectric transducers are detailed. The theoretical shape of the compressed impulsions for the nonlinear type of delay lines is discussed. ESRO

N74-11978# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
INVESTIGATIONS ON THE ATTENUATION OF ELECTROMAGNETIC WAVES BY RAIN AT 52, 90.8 AND 150 GHz Ph.D. Thesis - Tech. Univ. Berlin [UNTERSUCHUNGEN ZUR DAEMPFUNG ELEKTROMAGNETISCHER WELLEN DURCH REGEN BEI 52, 90.8 UND 150 GHz]
Joerg Sander 1972 110 p refs In GERMAN
(TB-153) Avail: NTIS HC $7.50

Theoretical and experimental results are presented of investigations involving relations between electromagnetic wave attenuation, rain intensity, and drop size distribution for millimeter waves in the range from 50 to 150 GHz. It is shown that the attenuation coefficients for 3.3 and 2 mm depend only on the scattering cross section of the distribution density. The error in determining the meteorologic parameters produces a nonneglectable contribution to the scattering of the experimental results. ESRO

N74-11979# Army Missile Command, Redstone Arsenal, Ala.
CAD-E TECHNIQUES IN MINOR CORRECTIVE REDESIGN OF A RELATIVELY UNRELIABLE FIELDED COMPONENT
John Cook and Larry Cristina 15 Jun. 1973 30 p refs
(DA Proj. 1X2-22233-D-690)
(AD-766707; RC-73-5) Avail: NTIS CSCL 17/9

The report describes an example of the use of computer-aided design and engineering (CAD-E) techniques in existing design analysis and evaluation. The concept was also further used as an auxiliary means for determining minor design correction(s) in accordance with established guidelines. Author (GRA)

N74-11980# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
FUSED SILICA DESIGN MANUAL, VOLUME 1
Joe N. Harris and Earle A. Welsh May 1973 152 p refs
(Contract N00017-72-C-4434)
(AD-766494; GIT-A-1403-Vol-1) Avail: NTIS CSCL 17/9

The manual provides a summary of the current status of the knowledge of designing radomes of slip-cast fused silica. It is intended to provide scientists and engineers designing and fabricating radomes and associated hardware a basic knowledge of the material and processing techniques as well as basic design information. Subjects covered in this manual are: fused silica raw material preparation, size reduction and slip preparation, slip casting, drying and firing, room temperature and elevated temperature properties. (Modified author abstract) GRA

N74-12608 Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
IMPATT AMPLIFIERS FOR COMMUNICATION SYSTEMS
H. C. Bowers and W. H. Lockyear *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)
Copyright.

N74-12609 Litton Industries, San Carlos, Calif.
A TWO WATT GUNN EFFECT TELECOMMUNICATIONS TRANSMITTER SOURCE
G. E. Lindgren *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12633 General Motors Technical Center, Warren, Mich. Engineering Staff.
AUTOMOTIVE RADAR: PROBLEMS AND PROMISES
T. O. Jones, D. M. Grimes (Mich. Univ., Ann Arbor), R. A. Dork, and W. R. Regueiro *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 8 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12642 Packett Communications, Inc., Waltham, Mass.
COMMUNICATIONS ARE TOO MUCH WITH US
Lee R. Talbert *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

N74-12643 Southern Pacific Communications Co., San Francisco, Calif.
SOUTHERN PACIFIC COMMUNICATIONS COMPANY AND THE SPECIALIZED COMMON CARRIERS
John J. Geier *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)
Copyright.

N74-12644 Pacific Telephone and Telegraph Co., San Francisco, Calif.
DATAPHONE DIGITAL SERVICE
R. A. Hiett *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

N74-12645 Fisher (Charles R.), San Diego, Calif.
THE ANALOGY OF THE EVOLUTION OF UTILITY NETWORKS TO COMPUTER COMMUNICATIONS
Charles R. Fisher *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 2 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12656 Quadracast Systems, Inc., San Mateo, Calif.
QUADRAPHONICS: THE SOUND OF THE SEVENTIES
Lou Dorren *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12658 National Semiconductor Corp., Danbury, Conn.
STATE-OF-THE-ART IN AUDIO IC'S 1973
Joe E. Byerly *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 13 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12660 Washington Univ., Seattle. Dept. of Electrical Engineering.
A HIGH PERFORMANCE SLOW SCAN TELEVISION MONITOR
Robert A. Greyell *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12662 San Francisco State Coll., Calif.
A DIGITAL SIGNAL SCANNER
Grant Connell *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N74-11981*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
A STUDY OF TECHNIQUES FOR PROCESSING MULTISPECTRAL SCANNER DATA
R. B. Crane, W. Richardson, R. H. Hieber, and W. A. Malila Sep. 1973 56 p refs
(Contract NAS9-9784)
(NASA-CR-134069; ERIM-31650-155-T) Avail: NTIS HC $5.00 CSCL 05B

A linear decision rule to reduce the time required for processing multispectral scanner data is developed. Test results are presented which justify the use of the new rule for digital processing whenever both accuracy and processing time are important. A method of evaluating the performance of the rule is also developed and applied to the problem of choosing a subset of channels. A technique used to find linear combinations of channels is described. The ability to extend signatures throughout a small area of approximately fifty square miles is tested. After preprocessing, signatures derived from the first of seven overlapping data sets are applied to all data sets. The test results show that the average probability of misclassification tends to increase with an increase in the number of data sets over which the signatures are extended. Author

N74-11982*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A METHOD OF BILLING THIRD GENERATION COMPUTER USERS
Philip N. Anderson and Delano R. Hyter Washington Dec. 1973 21 p
(NASA-TN-D-7515; M-545) Avail: NTIS HC $2.75 CSCL 09B

A method is presented for charging users for the processing of their applications on third generation digital computer systems is presented. For background purposes, problems and goals in billing on third generation systems are discussed. Detailed formulas are derived based on expected utilization and computer component cost. These formulas are then applied to a specific computer system (UNIVAC 1108). The method, although possessing some weaknesses, is presented as a definite improvement over use of second generation billing methods. Author

N74-11983# Joint Publications Research Service, Arlington, Va.
INTEGRATED FAMILY OF COMPUTERS
S. Kipnis, A. Larionov, and V. Glushkov 4 Dec. 1973 15 p refs Transl. into ENGLISH from Nauka Zhizn (USSR), no. 8, 1973 p 2-11
(JPRS-60682) Avail: NTIS HC $3.00

An overview is presented of the development of an integrated computer complex which was designed for use by the Soviet bloc countries. D.L.G.

N74-11984# Joint Publications Research Service, Arlington, Va.
DISCUSSION ON THE PERFECTION OF CONTROL
I. Khalanovich 14 Nov. 1973 23 p Transl. into ENGLISH from Gudok (Moscow), 23 Jun., 5, 12, 20 Jul. 1973
(JPRS-60534) Avail: NTIS HC $3.25

The principle of the electronic data processing system is discussed, as it is applied to the organizing and coordinating activity of groups of people during production. Author

N74-11985*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
A COMPUTER PROGRAM TO DETERMINE THE POSSIBLE DAILY RELEASE WINDOW FOR SKY TARGET EXPERIMENTS
Norman H. Michaud 1973 151 p refs
(NASA-SP-3075; LC-72-600340) Avail: NTIS MF $1.45; SOD HC $2.60 Domestic Postpaid; HC $2.25 GPO Bookstore CSCL

098

A computer program is presented which is designed to determine the daily release window for sky target experiments. Factors considered in the program include: (1) target illumination by the sun at release time and during the tracking period; (2) look angle elevation above local horizon from each tracking station to the target; (3) solar depression angle from the local horizon of each tracking station during the experimental period after target release; (4) lunar depression angle from the local horizon of each tracking station during the experimental period after target release; and (5) total sky background brightness as seen from each tracking station while viewing the target. Program output is produced in both graphic and data form. Output data can be plotted for a single calendar month or year. The numerical values used to generate the plots are furnished to permit a more detailed review of the computed daily release windows.
Author

N74-11986# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
PROGRAM SYSTEM FOR INVESTIGATIONS ON ARTICULATE SPEECH [EIN PROGRAMMSYSTEM FUER DIE UNTERSUCHUNG VON SPRACHLAUTEN]
Eike Meyenberg 8 Sep. 1972 87 p In GERMAN
(TB-156) Avail: NTIS HC $6.50

A program system is described which makes it possible to record the characteristics of articulation. Several transformation methods were tested with regard to their effectiveness in following the characteristics of linked speech.
ESRO

N74-11987# Freiburg Univ. (West Germany). Inst. fuer Physik.
A COMPLETE ABSTRACT LAMBDA CALCULUS MACHINE
K. J. Berkling [1972] 44 p refs Submitted for publication
(Rept-C-16) Avail: NTIS HC $4.25

An algorithm was developed which uses the formal definition of the lambda calculus, thus enabling the construction method of the algorithm to serve also as proof of its correctness. The algorithm is complete with respect to the clash of variables problem. Appropriate renaming (alpha conversion) takes place if and only if necessary. Since the property of a twin to be reducible is undecidable, the algorithm may or may not terminate for irreducible terms. The algorithm is compared to the LISP, PAL, P.J. Landins SECD machine systems, and the reasons for their deficiencies are indicated.
ESRO

N74-11988# Freiburg Univ. (West Germany). Inst. fuer Physik.
COMPARISON OF FOURIER AND WALSH TRANSFORMATION COMPUTER TIMES [VERGLEICH DER RECHENZEIT VON FOURIER- UND WALSH-TRANSFORMATION]
G. Landwehr Mar. 1972 25 p refs In GERMAN
(Rept-C-18) Avail: NTIS HC $3.25

Run times for the Walsh-, fast Walsh-, Fourier-, and fast Fourier transformations were compared on the Univac 1106, IBM 7040, PDP 8/E, and Mincal 523 computers. The most important result in comparing the transformation times is that the fast Fourier and the fast Walsh transformations only differ by a factor of 1.5 (Univac 1106), 1.6 (IBM 7040), 5.1 (PDP 8/E), and 4.5 (Mincal 523). This shows, that the main advantage of the Walsh transformation as compared to the Fourier transformation in calculating time only leads to a relatively small benefit for modern computers.
ESRO

N74-11989# Maryland Univ., College Park. Computer Science Center.
DIGITAL PICTURE PROCESSING: PICTURES, ENHANCEMENT, MATCHING
Azriel Rosenfeld Aug. 1973 42 p
(Contract N00014-67-A-0239-0012)
(AD-766511) Avail: NTIS CSCL 09/2

The report consists of several parts of a forthcoming book on Digital Picture Processing, dealing with pictures and their computer representation; image enhancement; and picture matching.
Author (GRA)

N74-11990# Berkeley Enterprises, Inc., Newtonville, Mass.
RESEARCH IN COMPUTER-ASSISTED DOCUMENTATION OF NAVY COMPUTER PROGRAMS Final Report, 1 May 1970 - 30 Apr. 1973
Edmund C. Berkeley 25 Aug. 1973 58 p refs
(Contract N00014-70-C-0225; NR Proj. 049-251)
(AD-766497; Rept-8-230/73-Q20) Avail: NTIS CSCL 09/2

The purpose of the research here reported is to discover and develop methods and principles by means of which a computer program which has little or no documentation can be easily documented by a human programmer with the assistance of a computer. This report describes the subject, purpose, and limitations of this research; reports briefly on the documentation of a sample, complex program called DDT; and describes (partially) computer programs for computer-assisted documentation called SIMULATOR-ANALYZER, AUTOMATIC RELOCATOR, YANK, KNITTING MACHINE, CONCEPT MODULE RECOGNIZER, etc.
Author (GRA)

N74-11991# Illinois Univ., Urbana. Coordinated Science Lab.
DELAY FREE REALIZATION OF ASYNCHRONOUS SEQUENTIAL SWITCHING CIRCUITS USING CONSTRAINED GATE DELAY RATIOS M.S. Thesis
Steven Robert Palmquist Jul. 1973 42 p refs
(Contract DAAB07-72-C-0259)
(AD-766748; R-616; UILU-ENG-73-2218) Avail: NTIS CSCL 09/2

Asynchronous sequential circuits are sequential circuits which do not make use of a synchronizing clock signal. Such asynchronous circuits often fail to perform as predicted by their Boolean descriptions. This is due to the fact that physical switching elements exhibit inertial and stray delays which may cause a network to produce transient outputs unpredictable by Boolean algebra. Circuit malfunctions of this type are referred to as various forms of hazards. Existing methods for elimination of the effects of various types of combinational and sequential hazards may introduce new problems or simply be tedious to use. For example, the effects of combinational hazards can be eliminated by introducing redundant gates. It is the purpose of the paper to demonstrate methods of solving these problems using a knowledge of constrained maximum and minimum gate delays.
GRA

N74-11992# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
PARALLEL PROCESSING CHARACTERISTICS AND IMPLEMENTATION OF DATA MANIPULATING FUNCTIONS
Tse-yun Geng Jul. 1973 86 p refs
(Contract F30602-72-C-0281)
(AD-766279; RADC-TR-73-189) Avail: NTIS CSCL 09/2

The report shows that there exists a class of functions, called data manipulating functions, in sequential as well as parallel processors. The circuits used to achieve these functions can be considered to form an independent functional block, called a data manipulator. A basic organization applicable to both sequential and parallel processors is then suggested. The main deviation of a parallel processor organization from the conventional Von Neumann organization is seen to be in the bis (bit-slice) manipulating functions. A comprehensive set of bis manipulating functions (classified in four categories: permuting, replicating, spacing and masking) is given. In addition, it is shown that the data manipulator designs presented in this report are extremely flexible to suit the requirements of various parallel processors. (Modified author abstract)
GRA

N74-11993# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
URAL UNIVERSAL AUTOMATIC DIGITAL COMPUTER PROGRAMMING INSTRUCTIONS
L. G. Lapshina 19 Jan. 1973 39 p Transl. into ENGLISH of the publ. "Universalnyye Avtomaticheskiye Tsifrovyye Vychislitelnyye Mashiny Ural Instruktsiya po Proboamminovaniyu Chastl. Ustroystva-Vvodavyoda Kniga 8. Ustroystvo Pechatayuscheye Alfavitno-Tsifrovoye U-546, No. 8" USSR, 1969 p 1-22
(AD-754686; FTD-MT-24-1681-72) Avail: NTIS CSCL 09/2

The report represents part of the programming instructions for Ural type computers and presents a description of the block diagram and system of instructions for unit U-546, which is designed to function in Ural computer systems as an alphanu-

meric printer. The first section lists the technical characteristics, gives an elementary block diagram of the unit and explains certain characteristics of its operation. Detailed operation algorithms are described in the second section. The appendices contain conventional designations, sets of instructions, operations and basic signals. Author (GRA)

N74-11994# Maryland Univ., College Park. Computer Science Center.
DIGITAL PICTURE PROCESSING: MODELS
Azriel Rosenfeld Jan. 1973 32 p
(Contract N00014-67-A-0239-0062)
(AD-757044) Avail: NTIS CSCL 09/2

The report is the near-final version of Chapter 13 of a forthcoming book on digital picture processing. It covers descriptions of, and models for, pictures and scenes in terms of objects or regions; objects in terms of vertices and arcs; arcs in terms of chain codes, and regions in terms of pieces. Limitations of such models are discussed. Formal models (grammars, automata) are not treated. Author (GRA)

N74-12350 Joint Publications Research Service, Arlington, Va.
CONSTRUCTION OF AN OPERATIONAL SYSTEM FOR OPERATIVE DATA PROCESSING ON A COMPUTER
A. K. Artanova *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 91-102 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 104-111 (For availability see N74-12335 03-20)

N74-12592 Continental Consultants, Inc., Devon, Pa.
COMPUTER AIDED TEST DESIGN TODAY
Harry D. Kimp *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 9 p (For availability see N74-12580 03-34)
Copyright.

N74-12596 INTEL Corp., Santa Clara, Calif.
IMPACT OF MICRO COMPUTERS ON THE DESIGNER
H. Smith *In* WESCON The 1973 Wescon Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

N74-12598 Computer Automation, Inc., Irvine, Calif.
HOW ABOUT THE LOW COST ($1000) MINICOMPUTER?
Phillip A. Kaufman *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)
Copyright.

N74-12615 Hewlett-Packard Co., Cupertino, Calif.
IMPACT OF RECENT ADVANCEMENTS OF MEMORY TECHNOLOGIES ON PRODUCTS
Alan D. Marston *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 8 p (For availability see N74-12580 03-34)
Copyright.

N74-12623 California Instruments Co., San Diego.
THE DIGITAL MULTIMETER/COUNTER (DMCtm)
William E. Barker *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 3 p (For availability see N74-12580 03-34)
Copyright.

N74-12632 Philco-Ford Corp., Palo Alto, Calif. Western Development Labs.
COMPONENT TECHNOLOGY STATUS OF GIGABIT DATA RATE QUADRIPHASE SYSTEMS
Louis C. Cuccia *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12637 Lockheed Electronics Co., Los Angeles, Calif.
COMPUTER POWER SUPPLY CONSIDERATIONS
Donald F. Olker *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)
Copyright.

N74-12638 ACDC Electronics, Inc., Oceanside, Calif.
THE MULTIFORMITY OF POWER SUPPLY EQUIPMENT
Walter J. Hirschberg *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p (For availability see N74-12580 03-34)
Copyright.

N74-12639 Fluidyne Instrumentation, Oakland, Calif.
CALCULATOR-BASED SYSTEMS: PLUG-IN DATA ACQUISITION AND PROCESS CONTROL
Roger Jennings *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)
Copyright.

N74-12640 Tektronix, Inc., Beaverton, Oreg.
DATA ACQUISITION, PROCESSING AND DISPLAY - CALCULATORS-BASED
Jack D. Grimes and Ronald V. Hill *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)
Copyright.

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N74-11995 Wisconsin Univ., Madison.
ANALYSIS AND DESIGN OF A TRAVELING WAVE IMPATT DIODE AMPLIFIER Ph.D. Thesis
Stanley George Burns 1972 148 p
Avail: Univ. Microfilms Order No. 73-2532

The analysis of the TWI structure is approached in two ways. Initially a physical model is obtained by considering the energy interchange between an electric field and avalanche generated charge carriers propagating through a semiconductor at the scatter limited velocity. It is shown theoretically that for appropriate dimensions, the one-dimensional IMPATT model can be expanded into a two-dimensional model which exhibits traveling wave amplification. To verify this, the vector wave equation subject to boundary conditions and the presence of charge carriers is solved to yield eigenvalues which predict gain. The presence of the charges moving at the scatter limited velocity produce substantial shortening in the wavelength transverse to the motion of the charge carriers. Numerical results are given.
Dissert. Abstr.

N74-11996*# Southwest Research Inst., San Antonio, Tex. Dept. of Electronic Systems Research.
ENGINEERING TEST PROCEDURE FOR THE PATIENT ASSIST DEVICE
Melvin A. Schroder 19 Oct. 1973 28 p
(Contract NAS9-13582; SWRI Proj. 13-3702-001)
(NASA-CR-134125; ETP-1) Avail: NTIS HC $3.50 CSCL 09A

The test procedure completely tests the functioning of the patient assist device. All modes of operation are included in the test. Patient activated switches may be chosen for use with this device as desired. These switches, however, must be single-pole, single-throw, momentarily-on switches. Author

N74-11997# Joint Publications Research Service, Arlington, Va.
DISCRETE PHOTOELECTRIC TRACKING SYSTEM WITH STORAGE OF ERROR SIGNAL
Z. N. Kuteva and Yu. A. Sabinin 9 Nov. 1973 14 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 45, 1972 p 196-202
(JPRS-60491) Avail: NTIS HC $3.00

Two variants of discrete photoelectric tracking systems are discussed with improved threshold sensitivity providing tracking of light sources with one-order less brightness in comparison with continuous systems. Author

N74-11998# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
PHOTODIODE MODEL OF THE CADMIUM SULFIDE-LIQUID CRYSTAL ELECTROOPTIC TRANSDUCER
Jon Hoimes Oct. 1973 24 p refs
(RM-579) Avail: NTIS HC $3.25

Work being done to perfect a cadmium sulfide, liquid crystal, real time electrooptic transducer led to the need for a model based on photodiode semiconductor physics. The essential physical parameters of the cadmium sulfide-liquid crystal junction are determined. This model has general applicability and will enable improvement of the transducer through variation of its parameters. Author

N74-11999# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF HIGH VOLTAGE PHOTOCELLS AT LOW RADIATION INTENSITIES
A. P. Landsman, D. S. Strebkov, V. A. Unishkov, and V. A. Chvarkova 16 Nov. 1973 8 p refs Transl. into ENGLISH from Geliotekhnika (Tashkent), no. 1, 1973 p 3-6
(JPRS-60570) Avail: NTIS HC $3.00

The volt-ampere characteristics of high-voltage photocells with junctions at radiation intensities varying from 20-2500 lux are examined. The emf was found to vary linearly with the radiation intensity up to 300 lux. Author

N74-12000# Atomics International, Canoga Park, Calif.
SPACE NUCLEAR SYSTEM SHEATHED ELECTRICAL CABLES Summary Report
L. E. Donelan 30 Jun. 1973 24 p
(Contract AT(04-3)-701)
(AI-AEC-13089) Avail: NTIS HC $3.25

A metallic sheathed electrical cable is being developed for use with the zirconium hydride reactor power system. The positive protection to the conductor, and the insulation, provided by the metallic sheath is expected to increase the cable performance reliability from that of the previously utilized braided wire covered cables. Material and design studies were conducted to select the reference cable configuration. The reference design selected consisted of a single stainless steel clad 0.040-in. diameter conductor, encased within a 0.090-in. diameter stainless steel sheath, with compacted MgO insulation between the conductor and the sheath. Author (NSA)

N74-12001# Atomic Energy Commission, Washington, D.C.
SHORT COURSE ON THERMOELECTRIC DEVICES AND THEIR APPLICATIONS
N. V. Kolomoetz [1973] 30 p
(AEC-tr-7432) Avail: NTIS HC $3.50

Lecture notes for a course on thermoelectric devices and their uses are presented. The notes discuss low-, medium-, and high temperature thermopiles, procedures or measuring thermoelectric properties, and problems in increasing the efficiency of thermoelectric materials. NSA

N74-12002# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.
NEW ELECTROMECHANICAL FUNTIONAL UNITS AND THEIR PIEZO CERAMIC MATERIALS [NEUE ELEKTROMECHANISCHE FUNKTIONSELEMENTE UND PIEZOKERAMISCHE MATERIALIEN HIERZU]
Paul Henninger, Wilhelm Kuny, Eugene Traenkle, and Hermann Schichl Bonn Bundesmin. fuer Forsch. und Technol. Jul. 1973 111 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FBT-73-13) Avail: NTIS HC $7.75; ZLDI, Munich 22,90 DM

The theory required for designing piezoelectric ceramic surface wave filters, for preparing materials of very low porosity and of high piezoelectric quality, and for obtaining a sufficient surface finish are described. They are applied in radio and television technology, e.g. in TV-IF filters, in color channel filters, and FM-IF filters. ESRO

N74-12003# Ingenieurburo G. Hopp, Munich (West Germany).
EFFECT OF PULSED NUCLEAR RADIATION ON MODEL CIRCUITS. PART 1: COMPUTER PROGRAM RENS FOR NETWORK ANALYSIS [EINWIRKUNG GEPULSTER KERNSTRAHLUNG AUF MODELLSCHALTKREISE. BAND 1: EDV-NETZWERKANALYSEPROGRAMM RENS]
E. Gruen, R. Kossyk, B. Loerke, and W. Renz Bonn Bundeswehramt 1973 125 p In GERMAN; ENGLISH summary
(Contract T-0220-02220-01202)
(BMVg-FBWT-73-20) Avail: NTIS HC $8.25; Bundeswehramt 30 DM

The computer program RENS (radiation effects on network systems) was developed for transient analysis of electronic networks with extreme nonlinearities. The theoretical foundations are dealt with, the computer program is described, and the user's manual is given. ESRO

N74-12004# Ingenieurburo G. Hopp, Munich (West Germany).
EFFECT OF PULSED NUCLEAR RADIATION ON MODEL CIRCUITS. PART 2: APPLICATION OF THE COMPUTER PROGRAM RENS TO A TWO STAGE AMPLIFIER [EINWIRKUNG GEPULSTER KERNSTRAHLUNG AUF MODELLSCHALTKREISE. BAND 2: ANWENDUNG DES EDV-PROGRAMMES RENS AUF EINEN ZWEISTUFIGEN VERSTAERKER]
E. Gruen, R. Kossyk, B. Loerke, and W. Renz Bonn Bundeswehramt 1973 87 p refs In GERMAN; ENGLISH summary
(Contract T-0220-02220-01202)
(BMVg-FBWT-73-21) Avail: NTIS HC $6.50; Bundeswehramt 30 DM

The computer program RENS (Radiation effects on network systems) was developed for transient analysis of electronic networks with extreme nonlinearities. The Ebers-Moll transistor model is discussed. The construction and analysis of a two-stage transistor amplifier is given. The behavior of the amplifier when exposed to gamma or neutron irradiation was investigated. ESRO

N74-12005# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
CALCULATED IRREGULARITY FACTORS NO/N1 OF A STATIONARY GAUSSIAN PROCESS WITH A ONE-PEAK POWER DENSITY SPECTRUM [BERECHNUNG DES UNREGELMAESSIGKEITSFAKTORS NO/N1 FUER EINEN STATIONAEREN GAUSS-PROZESS MIT EINGIPFLIGEM SPEKTRUM DER LEISTUNGSDICHTE]
E. Haibach and H.-G. Koebler 1972 36 p refs In GERMAN Sponsored by the Deut. Forschungsgemeinschaft
(LBF-TB-97/72) Avail: NTIS HC $4.00

A Gaussian random process is obtained from the combination of a suitable random signal generator with a band pass filter that can be used for simulating a stochastic stress-time history in fatigue investigations. The irregulatity factor of the process was calculated for different settings of the filter in order to determine the possible variations for one parameter of the process that is known to affect the fatigue behavior. The results obtained for ideal and for real filter characteristics by varying the bandwidth and the attenuation are presented in the diagrams. The influence of background noise level and the effect of a limited upper test frequency on testing time is discussed. Author (ESRO)

N74-12006# Boeing Aerospace Co., Seattle, Wash.
THEORETICAL STUDY OF DIELECTRIC CATHODES Technical Report, Sep. 1972 - Mar. 1973
W. M. Leavens and R. C. Kennedy Jul. 1973 84 p refs
(Contract F29601-73-C-0003; ILIR Proj. 72-05)
(AD-766478; AFWL-TR-73-47) Avail: NTIS CSCL 09/1

Theoretical studies of intense relativistic electron beams with dielectric cathodes are presented. It is found that beams can propagate on dielectric rods with realistic charges and currents induced in a surface plasma. Space charge fields present during the initial beam propagation down the rod accelerate large numbers of light ions to energies comparable to the beam energy. These ions provide partial neutralization in the diode gap, allowing the beam flux at the anode to be high enough to form a dense plasma. The beam pinches in the anode plasma. The model presents opportunities for further development of dielectric cathodes. Experiments are recommended to clarify the phenomena occurring with dielectric cathodes. Author (GRA)

N74-12204 Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
ZENERS, DIODES AND TRANSISTORS
Roger L. Lohn *In* WESCON Improving Producibility 1973 29 p ref (For availability see N74-12203 03-15)
Copyright.

N74-12207 Federal Pacific Electric Co., Sanford, N.C.
ALUMINUM ELECTROLYTIC CAPACITORS
John E. Hand and Edward L. Bowling *In* WESCON Improving Producibility 1973 12 p refs (For availability see N74-12203 03-15)
Copyright.

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N74-12007*# Connecticut Univ., Storrs. Dept. of Electrical Engineering.
THE ADAPTIVE OBSERVER
Robert L. Carroll Oct. 1973 159 p refs
(Grants NGR-07-002-002; NSF GJ-9)
(NASA-CR-136082; TR-73-4) Avail: NTIS HC $10.00 CSCL 09E

The simple generation of state from available measurements, for use in systems for which the criteria defining the acceptable state behavior mandates a control that is dependent upon unavailable measurement is described as an adaptive means for determining the state of a linear time invariant differential system having unknown parameters. A single input output adaptive observer and the reduced adaptive observer is developed. The basic ideas for both the adaptive observer and the nonadaptive observer are examined. A survey of the Liapunov synthesis technique is taken, and the technique is applied to adaptive algorithm for the adaptive observer. T.M.R.

N74-12008# Danish Research Center for Applied Electronics, Hoersholm.
LINEAR HF TRANSISTOR MODELS: ADAPTION BETWEEN MEASUREMENTS AND ANALYSIS BY COMPUTER
P. Stangerup Sep. 1973 36 p refs Presented at AGARD Conf. on Computer Aided Design for Electron. Circuits, Lyngby, Denmark, May 1973
(ECR-34) Avail: NTIS HC $4.00

The efficient utilization of the large amount of data obtained from a network analyzer was studied to develop a simple program for small computers or small time-sharing systems. The requirements for a general analysis program for linear circuits of moderate size are discussed along with transistor models. Comparisons between equivalent circuits and mathematical models are presented. It is concluded that at the higher frequencies, the best representation of the transistor is the S-matrix. F.O.S.

N74-12009# National Research Council of Canada, Ottawa (Ontario).
A DIGITAL FIELD REGULATOR FOR SYNCHRONOUS GENERATORS
Yu. M. Gorskii, V. S. Vainer-Krotov, and V. A. Ushakov 1973 15 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), v. 3, 1971 p 9-13
(NRC-TT-1705) Avail: NTIS HC $3.00

The design principles are considered of high speed heavy duty digital field regulators, the static and dynamic stability indices of which would not be inferior to the existing continuous operation regulators, and the algorithmic possibilities of which would create conditions for conversion to multichannel control systems capable of adaptation and automatic control, for example, for a digital group complex regulator. Requirements for the structure of the digital computer of the regulator were ascertained and the dynamic characteristics and the magnitudes and nature of the errors in forming the stabilizing effects due to level and sampling time were determined. A regulator model subjected to testing did not have optimal parameters and characteristics, and its potential has not been fully realized. Author

N74-12010*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN AND EVALUATION OF CONTROLS FOR DRIFT, VIDEO GAIN, AND COLOR BALANCE IN SPACEBORNE FACSIMILE CAMERAS
Stephen J. Katzberg, W. Lane Kelly, IV, Carroll Rowland, and Ernest E. Burcher Washington Dec. 1973 33 p refs Original contains color illustrations
(NASA-TN-D-7333; L-8845) Avail: NTIS HC $3.00 CSCL 14E

The facsimile camera is an optical-mechanical scanning device which has become an attractive candidate as an imaging system for planetary landers and rovers. This paper presents electronic techniques which permit the acquisition and reconstruction of high quality images with this device, even under varying lighting conditions. These techniques include a control for low frequency noise and drift, an automatic gain control, a pulse-duration light modulation scheme, and a relative spectral gain control. Taken together, these techniques allow the reconstruction of radiometrically accurate and properly balanced color images from facsimile camera video data. These techniques have been incorporated into a facsimile camera and reproduction system, and experimental results are presented for each technique and for the complete system. Author

N74-12011*# New Mexico State Univ., Las Cruces. Engineering Experiment Station.
A COMPUTER MODEL OF A PHASE LOCK LOOP M.S. Thesis
Ralph Paul Shelton [1973] 76 p refs
(Contract NGR-32-003-037)
(NASA-CR-134137) Avail: NTIS HC $6.00 CSCL 09C

A computer model is reported of a PLL (phase-lock loop), preceded by a bandpass filter, which is valid when the bandwidth of the bandpass filter is of the same order of magnitude as the natural frequency of the PLL. New results for the PLL natural frequency equal to the bandpass filter bandwidth are presented for a second order PLL operating with carrier plus noise as the input. However, it is shown that extensions to higher order loops, and to the case of a modulated carrier are straightforward. The new results presented give the cycle skipping rate of the PLL as a function of the input carrier to noise ratio when the PLL natural frequency is equal to the bandpass filter bandwidth. Preliminary results showing the variation of the output noise power and cycle skipping rates of the PLL as a function of the loop damping ratio for the PLL natural frequency equal to the bandpass filter bandwidth are also included. Author

N74-12012# Joint Publications Research Service, Arlington, Va.
DISCHARGE OF A SUPERCONDUCTING STORAGE
V. V. Andrianov, V. B. Zenkevich, O. V. Popkov, B. N. Sergeyenkov, A. G. Sukhorukov, V. V. Sychev, V. A. Tovma, and V. S. Sheynkman 20 Nov. 1973 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 196, no. 2, 1971 p 320-323
(JPRS-60590) Avail: NTIS HC $3.00

A discussion is presented on the possibility of using superconducting inductive storage devices with a semicondutor inverter for high efficiency performance. Author

N74-12013# Alabama Univ., Huntsville. Div. of Graduate Programs and Research.
STUDY OF DISTURBANCE ABSORBING CONTROLLERS FOR THE SERVOMECHANISM PROBLEM, PART 1 Final Technical Report, Apr. 1972 - Jun. 1973
Carroll D. Johnson and Harold D. Hunt Jun. 1973 146 p refs
(Contract DAAH01-72-C-0428)
(AD-766742) Avail: NTIS CSCL 12/1

A restricted theory for design of disturbance absorbing servo controllers was developed by Dr. C. D. Johnson in 1971. In the report that theory is tested by means of several numerical examples which are worked out in detail and simulated on an analog computer. Performance tests conducted on the analog

simulations verified the on-line, real-time effectiveness of the theory. Author GRA

N74-12014# Army Electronics Command, Fort Monmouth, N.J.
COMPUTER-AIDED DESIGN, SIMULATION AND OPTIMIZATION FOR MICROWAVE INTEGRATED CIRCUITS
Vladimir Gelnovatch Aug. 1973 152 p refs
(Contract DA Proj. 1S6-62705-A-440)
(AD-766677; ECOM-4146) Avail: NTIS CSCL 09/5

A realistic design approach, specifically directed at the successful implementation of microwave integrated circuits, involves the use of measured data to represent complex devices and the use of an effective CAD (Computer Aided Design) program to iteratively analyze, simulate, and optimize the performance of a given circuit. By means of a variety of techniques the designer may make effective use of the computer to perform the measurement characterization of an unknown device, reduce the data to a form suitable for further processing and perform a circuit analysis; changing critical element parameters in an intelligent manner until specific requirements are met. The execution of the iterative analysis may be performed automatically by incorporating an efficient self-optimization algorithm in order to achieve some optimal objective. A variety of these techniques have been described in some detail. Several examples of the computer simulation of the anticipated performance of certain types of solid state microwave integrated circuit amplifiers have demonstrated the effectiveness of using actual measured device data and CAD to realize an optimum circuit design. The results obtained on these amplifier modules working under conditions identical to those specified in their simulation have proved to be in excellent agreement. Author (GRA)

N74-12208 Texas Instruments, Inc., Dallas.
INTEGRATED CIRCUIT QUALITY AND RELIABILITY CONSIDERATIONS
Jim D. Adams and D. Dwayne Ballew *In* WESCON Improving Producibility 1973 7 p refs (For availability see N74-12203 03-15)
Copyright.

N74-12209 Hewlett-Packard Co., Palo Alto, Calif.
OPTOELECTRONIC COMPONENTS: LEDS, DISPLAYS, COUPLERS
Hans O. Sorensen and Richard A. Fellows *In* WESCON Improving Producibility 1973 28 p refs (For availability see N74-12203 03-15)
Copyright.

N74-12211 Autonetics, Anaheim, Calif.
UNDERCUT: THE NEMESIS OF SUBTRACTIVE CIRCUIT BOARD PROCESSES
W. S. DeForest *In* WESCON Improving Producibility 1973 5 p refs (For availability see N74-12203 03-15)
Copyright.

N74-12212 Photocircuits Corp., Glen Cove, N.Y.
THE STATUS OF ADDITIVE TECHNOLOGY TODAY
George Messner *In* WESCON Improving Producibility 1973 7 p refs (For availability see N74-12203 03-15)
Copyright.

N74-12213 Xerox Corp., El Segundo, Calif.
BARE PRINTED CIRCUIT BOARD TESTING
Rod Dixon *In* WESCON Improving Producibility 1973 3 p (For availability see N74-12203 03-15)
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N74-12214 Synergistic Products, Inc., Irvine, Calif.
AUTOMATED DIP INSERTION
Jeff Jones *In* WESCON Improving Producibility 1973 5 p (For availability see N74-12203 03-15)
Copyright.

N74-12593 Digitest Corp., Dallas, Tex.
ESTABLISHING TEST REQUIREMENTS FOR DIGITAL NETWORKS
In WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p ref (For availability see N74-12580 03-34)
Copyright.

N74-12594 Fairchild Camera and Instrument Corp., Palo Alto, Calif.
FAIRTEST: A SYSTEM FOR COMPUTER AIDED DESIGN OF TEST PROGRAMS FOR DIGITAL LOGIC MODULES
Ernest J. Collins *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 13 p (For availability see N74-12580 03-34)
Copyright.

N74-12595 AAI Corp., Baltimore, Md.
COMPUTER AIDED TEST GENERATION FOR ANALOG CIRCUITS
A. M. Greenspan and L. J. Rytter *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p (For availability see N74-12580 03-34)
Copyright.

N74-12597 National Semiconductor Corp., Santa Clara, Calif.
APPLICATIONS OF LSI PROCESSORS
Bala Parasuraman *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 8 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12604 Sandia Labs., Albuquerque, N.Mex.
EXPANDABLE MODELING OF BIPOLAR DEVICES
J. G. Fossum *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs Sponsored by AEC (For availability see N74-12580 03-34)
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N74-12605 Bell Telephone Labs., Inc., Holmdel, N.J.
CHOOSING THE RIGHT MODEL
W. J. McCalla *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12606 Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
A BIPOLAR TRANSISTOR MODEL FOR DEVICE AND CIRCUIT DESIGN
Ronald B. Schilling *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 2 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12607 Arizona State Univ., Tempe. Dept. of Electrical Engineering.
AN INTEGRAL CHARGE CONTROL MODEL (ICCM): THEORY AND EXPERIMENT
Carl R. Zimmer *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs (For availability see N74-12580 03-34)
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N74-12610 California Microwave, Inc., Sunnyvale.
PRESENT CAPABILITIES OF PHASE-LOCK OSCILLATORS
Irvin H. Solt, Jr. *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p (For availability see N74-12580 03-34)
Copyright.

N74-12611 Farinon Electric, San Carlos, Calif.
COMPUTERIZED OPTIMIZATION OF MICROWAVE OSCILLATORS
Les Besser *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12614 National Semiconductor Corp., Santa Clara, Calif.
THE PROGRAMMABLE LOGIC ARRAY AS A DESIGN TOOL
Dale Mrazek *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p (For availability see N74-12580 03-34)
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N74-12620 Tektronix, Inc., Beaverton, Oreg.
WILL INTERCONNECTABLE PLUG-INS MEET YOUR TEST AND MEASUREMENTS NEEDS BETTER?
Jerry L. Shannon *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1972 4 p (For availability see N74-12580 03-34)
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N74-12626 Varian Associates, Palo Alto, Calif.
MILLIMETER AND MICROWAVE TEA CIRCUITS AND PERFORMANCE
R. E. Goldwasser *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)
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N74-12627 Varian Associates, Palo Alto, Calif. Solid State West Div.
DESIGN AND FABRICATION OF TRANSFERRED ELECTRON (GUNN) AMPLIFIER DIODES
James F. Caldwell *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)
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N74-12628 Hewlett-Packard Co., Palo Alto, Calif.
THE CENTRAL PROCESSOR UNIT (CPU): AN INTEGRAL PART OF MEASURING INSTRUMENTS
France Rode *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
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N74-12651 Litronix, Cupertino, Calif.
LIGHT EMITTING DIODES: A TUTORIAL
David A. Laws and Robert Santos *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p (For availability see N74-12580 03-34)
Copyright.

N74-12655 General Motors Corp., Kokomo, Ind. Delco Electronics Div.
AUTOMOTIVE ELECTRONICS
Ronald W. Vahle *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 12 p (For availability see N74-12580 03-34)
Copyright.

N74-12657 Signetics Corp., Sunnyvale, Calif.
A SOLID STATE TIMER DEVICE FOR THE CONSUMER
Jim Wyland *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)
Copyright.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N74-12015*# Kanner (Leo) Associates, Redwood City, Calif.
ON THE EFFECT OF RELIABILITY OF SIMULATION RESULTS ON THE METHODOLOGY OF FLIGHT TESTING AND SIMULATION
R. Kaestner Washington NASA Nov. 1973 10 p Transl. into ENGLISH from DGLR report DLR-Mitt-72-18, Oct. 1972 p 93-99 Presented at the 3rd meeting of the DGLR-Symposium, Flight Testing Technology: Reliability of Results Derived from Simulation in Comparison with Results of Actual Flight, Bremen, 28 Apr. 1972
(Contract NASw-2481)
(NASA-TT-F-15175; DLR-Mitt-72-18) Avail: NTIS HC $3.00 CSCL 14B

Various methods of flight simulation are described and a comparison of the results obtained by flight simulators are discussed. The VAK 191 B aircraft is used as an example of typical takeoff and landing performance for STOL aircraft. Diagrams of the aircraft attitude control during transition phases following takeoff and during, landing approach are provided. Techniques used by the test pilot in conducting the flight tests are described. Author

N74-12016*# Xerox, Rochester, N.Y.
REFURBISHMENT OF SOLAR SIMULATION OPTICAL TRAIN MIRROR ASSEMBLIES Final Report
W. R. Leverton Sep. 1973 29 p
(Contract NAS9-11461)
(NASA-CR-134123; EOS-1155) Avail: NTIS HC $3.50 CSCL 14B

Mirror refurbishment processing is described, and the results of processing 251 mirror assemblies are reported. The mirror replica bonding, optical tests, electrical discharge machining, and vacuum coating are discussed. F.O.S.

N74-12017# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
NOTES CONCERNING TESTING TIME REQUIREMENTS IN STEADY AND UNSTEADY MEASUREMENTS
J. W. G. VanNunen 17 Jan. 1973 35 p Presented at the VKI Lecture Series on Large Transonic Windtunnels, 29 Jan. - 2 Feb. 1973
(NLR-MP-73002-U) Avail: NTIS HC $3.75 CSCL 14B

The time required to perform wind tunnel tests is considered as a parameter for designing new transonic wind tunnels. Pressure measurements, force measurements, flutter, and buffeting are discussed. F.O.S.

N74-12018# National Physical Lab., Teddington (England). Div. of Maritime Science.
A WIND TUNNEL INVESTIGATION INTO THE DESIGN OF A FILLING AND LAUNCHING SHELTER FOR METEOROLOGICAL BALLOONS
P. G. G. ONeill and M. J. Grubb Aug. 1973 27 p
(NPL-MAR-SCI-R111) Avail: NTIS HC $3.50

Wind-tunnel tests were carried out to develop a balloon filling shelter with improved airflow characteristics compared to the rectangular structure currently in use. An initial series of tests was carried out on a large number of 1:55 scale cardboard models. A model of the existing shelter was used as a standard for comparison with the various designs. Further tests were carried out on a 1:24 scale model for the most promising design which had an elliptical-planform. Finally tests were carried out on a 1:12 scale model of the elliptical-nosed planform design. A helium-filled by toy balloon was used to assess the effect of the airflow on handling and launching, and to establish the effect of overall length of the structure. The shorter-sided version of this model was used as a basis for the full-scale design. A discussion of the results is included. Author

N74-12019# Air Transport Association of America, Washington, D.C.
THE APRON-TERMINAL COMPLEX: ANALYSIS OF CONCEPTS FOR EVALUATION OF TERMINAL BUILDINGS Final Report, May 1972 - Sep. 1973
Sep. 1973 157 p refs Prepared in cooperation with Ralph M. Parsons Co., Los Angeles
(Contract DOT-FA72WA-2950)
(FAA-RD-73-82) Avail: NTIS HC $10.00

The principal considerations in the planning of airport apron-terminal areas are described. The apron-terminal area is defined as the area limited by the curb on the landside and the taxiway access to the apron on the airside. The major functional areas of the apron-terminal complex (curb, terminal, connector, and apron) are defined and described. The four principal concepts for apron-terminal complexes (pier, satellite, linear, and transporter) are analyzed and evaluated for suitability to specific airport situations, based primarily upon traffic levels, physical limitations, and station characteristics. The final report presents a consolidation of the conclusions, technical, economic, and

operational advantages and limitations; and underlying assumptions related to each apron-terminal area complex concept. Included are tabular and graphic materials to help in evaluating concepts. Author

N74-12020*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPARISON OF RESULTS FROM TWO SIMULATORS USED FOR STUDIES OF ASTRONAUT MANEUVERING UNITS
Eric C. Stewart and Robert L. Cannaday Washington Dec. 1973 47 p refs
(NASA-TN-D-7379; L-8988) Avail: NTIS HC $3.00 CSCL 14B

A comparison of the results from a fixed-base, six-degree-of-freedom simulator and a moving-base, three-degree-of-freedom simulator was made for a close-in, EVA-type maneuvering task in which visual cues of a target spacecraft were used for guidance. The maneuvering unit (the foot-controlled maneuvering unit of Skylab Experiment T020) employed an on-off acceleration command control system operated entirely by the feet. Maneuvers by two test subjects were made for the fixed-base simulator in six and three degrees of freedom and for the moving-base simulator in uncontrolled and controlled, EVA-type visual cue conditions. Comparisons of pilot ratings and 13 different quantitative parameters from the two simulators are made. Different results were obtained from the two simulators, and the effects of limited degrees of freedom and uncontrolled visual cues are discussed. Author

N74-12021*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK, VOLUME 18 Progress Report, Sep. - Oct. 1973
15 Dec. 1973 172 p refs
(Contract NAS7-100)
(NASA-CR-136225; JPL-TR-32-1526-Vol-18) Avail: NTIS HC $10.75 CSCL 17B

The objectives, functions, and organization of the Deep Space Network are summarized. The Deep Space Instrumentation Facility, the Ground Communications Facility, and the Network Control System are described. Author

N74-12022# Department of Supply, Mildura (Australia). Balloon Launching Station.
EQUIPMENT AND FACILITIES AVAILABLE FOR FLYING BALLOON-BORNE SCIENTIFIC EXPERIMENTS
May 1973 41 p
(NP-19816) Avail: AEC Depository Libraries HC $4.25

The facilities at Mildura are shown and the equipment, points of contact, finance arrangements, transportation, command and tracking equipment, and insurance requirements are discussed in detail. NSA

N74-12023# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Research Library.
PRODUCTION OF WELL KNOWN PRESSURES OF PURE AND MIXED GASES IN THE HIGH-VACUUM RANGE
G. Schneppe 17 May 1973 42 p refs Transl. into ENGLISH of Bonn Univ., Phys. Inst., report BMWF-FBW-69-05
(AD-766424; AFCRL-TR-73-0320; AFCRL-Trans-104; BMwF-FB-W-69-05) Avail: NTIS CSCL 14/2

A gas inlet system is described which uses the pressure-based dynamic expansion method to produce well-known pressures over the range from 1/(10 to the 4th) to less than 1/(10 to the 8th) torr. The average absolute accuracy is about 2%, and the reproducibility better than 1%. Adjustments of the test pressure are performed within a few seconds. The gas is introduced into the test volume through a porous glass filter. Its small conductance causes a strong pressure reduction, so that the reference pressure can be measured by a compensated capacity manometer, which in turn is calibrated against an Hg-U-manometer. This technique is suitable also for measurements of active and corrosive gases. In addition, the apparatus described consists of two independent gas inlet systems which allow them to produce gas mixtures as quickly and accurately as a pure gas pressure. It is useful for mass spectrometer calibration. (Modified author abstract) GRA

N74-12024# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
IMPROVED AIRFIELD RUNWAY LIGHT SET, OPERATIONAL AREA, AIRCRAFT: 1 1/2-KW, FEBRUARY 1972 - AUGUST 1972
Alvin E. Gates May 1973 70 p
(AD-766691; USAMERDC-2064) Avail: NTIS CSCL 01/5

The report covers the design, development, engineering design test, and evaluation of the improved airfield runway light set, operational area, aircraft: 1 1/2-kw. This light set may be used for marking military runways and taxiways for aircraft making take-offs and landings at night, or during restricted daytime visibility. (Modified author abstract) GRA

N74-12025# Lockheed-California Co., Burbank.
RIGID PAVEMENT DESIGN CHART CONSTRUCTION WITH LOCKHEED MODIFIED PCA PDILB COMPUTER PROGRAM
C. W. Foster 1 Sep. 1973 21 p refs
(AD-766915; LR-26049) Avail: NTIS CSCL 01/5

There has been a need for a more descriptive explanation of concrete rigid pavement design charts as used in the Airplane Characteristics for Airport Planning document. Lockheed has made certain modifications to the published Portland Cement Association (PCA) computer program which assisted in preparation of the charts. This explanation will permit one to better understand the development and use of the charts for the design and evaluation of airfield pavements as well as of the use of the program for landing gear design. GRA

N74-12026# Purdue Univ., Lafayette, Ind.
PREDICTING PAVEMENT PERFORMANCE USING TIME-DEPENDENT TRANSFER FUNCTIONS Technical Report, Nov. 1970 - Feb. 1973
R. E. Boyer and M. E. Harr Jul. 1973 223 p refs
(Contract F29601-71-C-0014; AF Proj. 683M)
(AD-766765; AFWL-TR-72-204) Avail: NTIS CSCL 01/5

A technique was developed to predict the performance of a pavement system subjected to dynamic load inputs. Transfer function theory was extended in connection with a decretized convolution procedure to define a pavement's time-dependent transfer functions. The transfer functions were calculated from data measured during full scale tests in a service environment. Subsequently, a method to predict deflection output responses was developed for use in conjunction with the calculated time-dependent transfer functions. It was concluded that the characteristics of a flexible pavement could be represented by a series of transfer functions obtained from dynamic tests using practically any prime mover. It was also concluded that the transfer functions contained certain isolated descriptors which were related to the aircraft gear configurations, and other descriptors which were only indicative of the pavement's behavior. (Modified author abstract) GRA

N74-12027# School of Aerospace Medicine, Brooks AFB, Tex.
FACILITIES AND CAPABILITIES OF THE UNITED STATES AIR FORCE SCHOOL OF AEROSPACE MEDICINE
W. Geoffrey Jewett, Arthur B. Davis, and Marion E. Green Jun. 1973 127 p
(AD-766239; SAM-TR-73-14) Avail: NTIS CSCL 06/5

The report outlines the four basic missions of the United States Air Force School of Aerospace Medicine: medical research and development, medical evaluation and consultation, medical education, and aeromedical support to USAF missions. The facilities and capabilities of each of the nine operational divisions are given in chapter format. The facilities summary outlines equipment specifications and the application of these resources to accomplish the overall mission requirements. Author (GRA)

N74-11857* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FACILITIES
Harold F. Battaglia, Frank A. Burgett, Lewis O. Casey, James V. Correale, Jack Q. Dunaway, Warren G. Glover, Arthur H. Hinners, Jr., James C. LeBlanc, Ted B. Leech, Jackie D. Mays et al *In* Its Skylab Med. Expt. Altitude Test (SMEAT) Oct. 1973 29 p
(For availability see N74-11854 03-04)
CSCL 14B

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N74-12028 Yale Univ., New Haven, Conn.
THE FLOW OF SUPERFLUID HELIUM THROUGH SMALL ORIFICES Ph.D. Thesis
Martin Edward Banton 1972 123 p
Avail: Univ. Microfilms Order No. 83-14234

The flow of superfluid helium through orifices of diameters 2.5, 5, and 7.5 microns has been investigated for the temperature range 0.4 K to 1.25 K. Temperatures below 1.25 K were produced by a He-3 refrigerator designed and built for this work. Work at 1.25 K with a 2.5 micron diameter orifice demonstrated that spontaneous jumps in the velocity of the superfluid occur in flow through orifices. There was evidence that in some cases the jumps were quantized in ratios of small integers. Data taken at 1.25 K with a 5 micron diameter orifice exhibited intrinsic behavior. No intrinsic behavior was seen at 0.4 K or 0.48 K. Also no intrinsic behavior was seen for a 7.5 micron orifice. Work with a 2.5 micron diameter orifice produced flow data which exhibited velocities comparable to those observed in the intrinsic flows. Other data taken on the 5 micron diameter orifice exhibited a low velocity mode of flow which was dependent of temperature and in which the velocity was dependent on the driving pressure. Dissert. Abstr.

N74-12029 Stanford Univ., Calif.
UNSTEADY VISCOUS EFFECTS IN THE FLOW OVER AN OSCILLATING SURFACE Ph.D. Thesis
James Ian Lerner 1973 207 p
Avail: Univ. Microfilms Order No. 73-14926

A theoretical model for the interaction of a turbulent boundary layer with an oscillating wavy surface over which a fluid is flowing is developed, with an application to wind-driven water waves and to panel flutter in low supersonic flow. A systematic methodology is developed to obtain the surface pressure distribution by considering separately the effects on the perturbed flow of a mean shear velocity profile, viscous stresses, the turbulent Reynolds stresses, compressibility, and three-dimensionality. The problem is formulated initially for an inviscid incompressible two-dimensional shear layer of constant thickness, and the analysis is restricted to small-amplitude wavy surfaces and to thin boundary layers. The resulting linearized equations are reduced to ordinary differential equations in the transverse space coordinate by assuming simple harmonic time dependence and taking the Fourier transform with respect to the streamwise space variable. Dissert. Abstr.

N74-12030 California Univ., Los Angeles.
INSTABILITIES IN BUOYANCY-DRIVEN BOUNDARY LAYER FLOWS OVER INCLINED SURFACES Ph.D. Thesis
Prakash Appadurai Iyer 1973 155 p
Avail: Univ. Microfilms Order No. 73-13146

Stability problems in stratified flows over inclined surfaces are discussed. The stability of free convection flows over a heated wall with a homogeneous ambient fluid for various tilt angles with respect to the vertical is analyzed. Infinitesimal disturbances are considered, and a linear theory is used. Traveling waves periodic in the streamwise direction are first considered, and their stability characteristics are then compared with those for stationary longitudinal vortices periodic in the spanwise direction. The linear stability of the free convection flow over a heated or cooled inclined wall situated in a stably stratified fluid is reported. The system considered models the mountain-valley winds observed in the atmosphere. Both traveling waves periodic in the flow direction and stationary longitudinal vortices are considered for various Prandtl numbers. Dissert. Abstr.

N74-12031 California Univ., San Diego.
SHORT DURATION STRESS PULSE PROPAGATION IN SOLIDS AND LIQUIDS Ph.D. Thesis
Michael Paul Felix 1973 153 p
Avail: Univ. Microfilms Order No. 73-14576

Experimental evidence of plane, dilatational stress wave scattering and attenuation in solids and liquids by a previously unsuspected mechanism is presented. The stress wave is laser generated and is in the form of a short duration (250 nanoseconds) compressive stress pulse that propagates through the material. Stress-time profiles at two different positions along the propagation drection in the material are obtained by fast response piezoelectric transducers. The incident compressive stress pulse is distorted during propagation, and this distortion is shown to be caused by scattering of the wave in the material. The scattering in the liquids is shown to result from the impinging of the propagating wave upon the many small voids of dissolved gas known to be in some liquids. The scattering in the solids is believed to be caused by the stress wave hitting the numerous defect related voids that are known to exist in practically all real solids. Dissert. Abstr.

N74-12032 Illinois Univ., Urbana.
THERMOCONVECTION IN A BOUNDED CYLINDRICAL FLUID LAYER Ph.D. Thesis
Gary Samuel Charlson 1972 194 p
Avail: Univ. Microfilms Order No. 73-17149

An analytic study is made of natural convection induced in a cylindrical layer of fluid by uniform heating from below. The fluid layer is bounded laterally by a solid right circular cylinder with the cylinder height to radius ratio a variable. The onset of natural convection in cylindrical fluid layers heated uniformly from below is investigated as a function of the layer dimensions. Upper and lower bounds to the critical Rayleigh number characterizing the onset of convection are computed using a variational formulation for the mathematical system. The structure of the convective flow at onset is investigated and is found to be in in agreement with experimental observations.
Dissert. Abstr.

N74-12033 Texas Univ., Austin.
A STUDY OF THE FLOW FIELD PRODUCED BY AN AXISYMMETRIC, UNDEREXPANDED JET EXHAUSTING INTO A CYLINDRICAL TUBE Ph.D. Thesis
James Lucian Batson 1972 119 p
Avail: Univ. Microfilms Order No. 73-18399

The investigation, which was primarily of an experimental nature, was undertaken to define the flow field produced when an underexpanded jet is exhausted from a conical nozzle into a cylindrical tube. The experimental data included the reservoir conditions for the nozzle, the static pressure distribution along the cylinder wall, pitot probe surveys at the cylinder exist, and photographs of the flow exhausting from the tube. Of principal concern were the effects on the flow field of tube length, of reservoir conditions, and of test time. Although room-temperature nitrogen was used as the test gas in most of the tests, several tests used actual rockets statically fired into the same cylindrical tubes. The experimentally determined flow field characteristics were compared with the experimental data of others, with a method of characteristics analysis developed for the investigation, and with a flow field model. Dissert. Abstr.

N74-12034 New York Univ., N.Y. School of Engineering and Science.
ANALYSIS OF THE LOW-SPEED FLOW OVER A SLENDER SHARP EDGED DELTA WING AT ANGLES OF ATTACK Ph.D. Thesis
Paul LeRoy Coe, Jr. 1973 75 p
Avail: Univ. Microfilms Order No. 73-19383

The phenomena of rolled-up vortex cores above the lee surface of slender bodies, at angle of attack, has been observed since the advent of the highly swept-wing aircraft. Recent investigations indicate that these vortices exhibit large effects on the longitudinal and lateral stability of these configurations. A better understanding of the effect of this separated-vortex phenomena is therefore essential for the efficient design of stable high lift aircraft at subsonic speeds. Because of its geometric simplicity, an untwisted, uncambered, thin, sharp-edged, slender delta wing in subsonic flow is considered. Experimental studies have established the essential features of this type of flow as follows: (1) separation of flow at the leading edges. (2) formation of rolled-up vortex cores above the lee surface. (3) entrainment of mass by the vortex cores. (4) strong axial velocities along the

vortex cores. (5) conical flow over the major portion of the wing (with the exception of the apex and trailing edge).
Dissert. Abstr.

N74-12035 Virginia Univ., Charlottesville.
ANALYSIS OF MERGED LAYER REGIME ON A SHARP CONE AT ZERO INCIDENCE Ph.D. Thesis
Santosh Kumar 1973 96 p
Avail: Univ. Microfilms Order No. 73-189-73

Hypersonic low density flow past a semi-infinite sharp cone was studied. Only the merged layer regime was considered. Motivation for the study was to extend the two-layer formulation to non-similar solution cases. The shock structure problem is treated within the Navier-Stokes formulation while the viscous layer was taken to be non-similar and of the boundary layer type. For the shock structure problem, analytical expressions are obtained for the following quantities to zeroth order in inverse Reynolds number: (1) conservation of mass flux across the viscous layer-shock wave interface, (2) numerical matching of normal gradients in velocity resulting from the curved shock and from the viscous layer, and (3) numerical matching of state variables and velocity components at the shock-viscous layer interface.
Dissert. Abstr.

N74-12036 Minnesota Univ., Minneapolis.
GENERATION OF INTERNAL WAVES IN STRATIFIED FLUIDS Ph.D. Thesis
Chyisheng Hwang 1973 128 p
Avail: Univ. Microfilms Order No. 73-18117

Hurley has transformed the pressure function for a two-dimensional small motion in an exponentially stratified infinite fluid into Bessel's equation of zero order. The author applied a similar transformation to the equation of stream function. The transformed equation is again a Bessel's equation of zero order. The velocity distribution derived from a particular solution to the equation is like that of a vortex near the origin and of a traveling wave at large distance. The velocity distribution also shows that there are two lines of singularities associated with each vortex or source. A theory was developed for the finite fluid depth by using an image method. The image method is a special arrangement of three-row vortices or sources so that the singularities are all cancelled throughout the flow field.
Dissert. Abstr.

N74-12037 Johns Hopkins Univ., Baltimore, Md.
EXPERIMENTS ON THE NEARLY ISOTROPIC TURBULENCE BEHIND A JET GRID Ph.D. Thesis
Mohamed Abo-el-Fath Mohamed Gad-el-Hak 1973 731 p
Avail: Univ. Microfilms Order No. 73-16642

Wind tunnel turbulence behind a parallel rod grid with jets evenly distributed along each rod is nearly isotropic. Homogeneity improvement over prior related experiments was attained by the use of controllable nozzles. Compared with the passive case, the downwind jet active grid gives a smaller static pressure drop across it and a smaller turbulence level at a prescribed distance from it, while the upwind jet grid gives a larger static pressure drop and a larger turbulence level. Counterflow injection apparently increases the effective solidity, causing instability, larger turbulent energy and larger scales. If the inverse turbulent kinetic energy is approximated as a power law of distance, the exponent decreases with increasing downwind or upwind jet strength, corresponding to slower decay rates.
Dissert. Abstr.

N74-12038 Oklahoma State Univ., Stillwater.
THE EFFECT OF A DILUTE, DRAG-REDUCING MACROMOLECULAR SOLUTION ON THE TURBULENT BURSTING PROCESS Ph.D. Thesis
George L. Custer Donohue 1972 124 p
Avail: Univ. Microfilms Order No. 73-15084

A study was conducted to determine if the addition of drag reducing macromolecules modifies the production of kinetic energy in turbulent wall flows or if these additions alter the structure of the viscous sublayer. Both water and dilute drag reducing polyethylene oxide-water solution were used as working fluids. Analysis of the motion pictures show that the ejection rate of low momentum fluid away from the wall in a 139 wppm solution of PEO is 70% lower than the rate in an equal mass flow rate of water. Also, the nondimensional spacing of the low speed streaks was increased from lambda (+) = 96 for water to lambda (+) = 170 for a 26 per cent drag reducing solution. This evidence strongly suggests that the drag reducing polymers are reducing wall shear by modifying the production link in the turbulent energy chain. Also, the laser anemometer measuring individual realizations was able to accurately and measure the statistical properties of a highly fluctuating flow field. Author

N74-12039 Oklahoma State Univ., Stillwater.
AN EMPIRICAL TECHNIQUE FOR OPTIMIZATION OF VARIABLE POROSITY TRANSONIC WIND-TUNNEL FLOWS Ph.D. Thesis
John William Davis 1972 138 p
Avail: Univ. Microfilms Order No. 73-15088

A scientific procedure is developed by which the transonic flow wave cancellation process can be studied on a mathematical basis and which can be used to predict optimum values of variable porosity transonic wind tunnel parameters that can be expected to yield minimum wave interference on the aerodynamic test model. The significant parameters are identified by means of an analysis of thin wall and thick wall theory and by a review of past experimental work. By means of a quasi-linear multiple regression technique, a mathematical model is developed by which a performance index relating experimental results to known interference-free reference measurements can be used to solve for the optimum wind tunnel settings using the method of steepest ascent (descent). A technique has been developed which is capable of determining the optimum variable porosity transonic wind tunnel configuration for which reflected wave interference should be at a minimum level.
Dissert. Abstr.

N74-12040*# Alabama Univ., Huntsville. Div. of Graduate Programs and Research.
INVESTIGATION OF SCALING CHARACTERISTICS FOR DEFINING DESIGN ENVIRONMENTS DUE TO TRANSIENT GROUND WINDS AND NEAR-FIELD, NONLINEAR ACOUSTIC FIELDS Final Technical Report
Cornelius C. Shih Sep. 1973 135 p refs
(Contract NAS8-28249)
(NASA-CR-120101) Avail: NTIS HC $8.75 CSCL 20D

In order to establish a foundation of scaling laws for the highly nonlinear waves associated with the launch vehicle, the basic knowledge of the relationships among the parameters pertinent to the energy dissipation process associated with the propagation of nonlinear pressure waves in thermoviscous media is required. The problem of interest is to experimentally investigate the temporal and spacial velocity profiles of fluid flow in a 3-inch open-end pipe of various lengths, produced by the propagation of nonlinear pressure waves for various diaphragm burst pressures of a pressure wave generator. As a result, temporal and spacial characteristics of wave propagation for a parametric set of nonlinear pressure waves in the pipe containing air under atmospheric conditions were determined. Velocity measurements at five sections along the pipes of up to 210 ft. in length were made with hot-film anemometers for five pressure waves produced by a piston. The piston was derived with diaphragm burst pressures at 20, 40, 60, 80 and 100 psi in the driver chamber of the pressure wave generator.
Author

N74-12041*# Illinois Univ., Urbana.
MACH REFLECTION, MACH DISC, AND THE ASSOCIATED NOZZLE FREE JET FLOWS Ph.D. Thesis
I-Shih Chang [1973] 140 p refs
(Grant NGL-14-005-140)
(NASA-CR-136084) Avail: NTIS HC $9.00 CSCL 20D

The numerical method involving both the method of integral relations and the method of characteristics have been applied to investigate the steady flow phenomena associated with the accurrence of Mach reflection and Mach disc from nozzle flows. The solutions of triple-shock intersection are presented. The regime where Mach configuration appears is defines for the inviscid analysis. The method of integral relations developed for the blunt body problem is modified and extended to the attached shock wave and to internal nozzle flow problems.
Author

N74-12042# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
EFFECTS OF STREAMLINE CURVATURE ON TURBULENT

FLOW

P. Bradshaw Paris GARD Aug. 1973 36 p refs
(AGARD-AG-169; AGARDograph-169) Avail: NTIS HC $4.00

Streamline curvature in the plane of the mean shear produce surprisingly large changes in the turbulence structure of shear layers. These changes are usually an order of magnitude more important than normal pressure gradients and other explicit terms appearing in the mean-equations for curved flows. The effects on momentum and heat transfer in boundary layers are noticeable on typical wing sections and are very important on highly-cambered turbomachine blades; turbulence may be nearly eliminated on highly-convex surfaces, while on highly-concave surface momentum transfer by quasi-steady longitudinal vortices dominates the ordinary turbulence processes. The greatly enhanced mixing rates of swirling jets and the characteristic non-turbulent cores of trailing vortices are also consequences of the effects of streamline curvature on the turbulence structure.
Author

N74-12043*# Kanner (Leo) Associates, Redwood City, Calif.
NONSTEADY-STATE SHOCK WAVE FRONTS AND THEIR INTERACTION

Sebastian VonHoerner Washington NASA Nov. 1973 81 p refs Transl. into English from Fortschr. Phys. (East Ger.), v. 6, no. 7-8, 1958 p 375-425
(Contract NASw-2481)
(NASA-TT-F-15168) Avail: NTIS HC $6.25 CSCL 20D

The results of an investigation on shock waves and their interactions are reported. If a single planar strong shock wave is propagated in a gas of uniform density and velocity and no large supply of momentum is applied from behind, all initial distributions of density, velocity and temperature behind the front approach the same distribution, called the standard solution, asymptotically after a short period. Radiation loss is calculated and applied to astronomical data. The limiting case of very strong radiation yields the nonsteady isothermal shock wave. A study of shock waves in magnetic fields indicates the existence of three different kinds of waves. Sample calculations are made for the interaction of two nonsteady, parallel, strong shock waves. The treatment of a field of interacting shock waves with Monte Carlo methods is outlined.
Author

N74-12044*# Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.
A SYSTEMATIC EXPERIMENTAL INVESTIGATION OF SIGNIFICANT PARAMETERS AFFECTING MODEL TIRE HYDROPLANING

Gilbert A. Wray and I. Robert Ehrlich Jul. 1973 81 p refs
(Contract NAS1-9349; DL Proj. 3628/480/464/465)
(NASA-CR-132346; SIT-DL-72-1602) Avail: NTIS HC $6.25 CSCL 20D

The results of a comprehensive parametric study of model and small pneumatic tires operating on a wet surface are presented. Hydroplaning inception (spin down) and rolling restoration (spin up) are discussed. Conclusions indicate that hydroplaning inception occurs at a speed significantly higher than the rolling restoration speed. Hydroplaning speed increases considerably with tread depth, surface roughness and tire inflation pressure of footprint pressure, and only moderately with increased load. Water film thickness affects spin down speed only slightly. Spin down speed varies inversely as approximately the one-sixth power of film thickness. Empirical equations relating tire inflation pressure, normal load, tire diameter and water film thickness have been generated for various tire tread and surface configurations.
Author

N74-12045*# LTV Aerospace Corp., Dallas, Tex. Vought Systems Div.
THERMAL AND FLOW ANALYSIS SUBROUTINES FOR THE SINDA-VERSION 9 COMPUTER ROUTINE

J. A. Oren and D. R. Williams 24 Sep. 1973 274 p refs
(Contract NAS9-6807)
(NASA-CR-134121; Rept-00-1582) Avail: NTIS HC $15.75 CSCL 20D

Fluid flow analysis, special thermal analysis and input/output capabilities of the MOTAR routine were incorporated into the SINDA routine. All the capabilities were added in the form of user subroutines so that they may be added to different versions of SINDA with a minimum of programmer effort. Two modifications were made to the existing subroutines of SINDA/8 to incorporate the above subroutines. These were: (1) A modification to the preprocessor to permit actual values of array numbers, conductor numbers, node numbers or constant numbers supplied as array data to be converted to relative numbers. (2) Modifications to execution subroutine CNFAST to make it compatible with the radiant interchange user subroutine, RADIR. This modified version of SINDA has been designated SINDA/version 9. A detailed discussion of the methods used for the capabilities added is presented. The modifications for the SINDA subroutines are described, as well as user subroutines. All subroutines added or modified are listed.
Author

N74-12046# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
LASER-ANEMOMETRY MEASUREMENTS IN THE VICINITY OF A GUTTER-STABILISED FLAME

D. F. G. Durao, A. Melling, S. Pope, and J. H. Whitelaw Jan. 1973 13 p ref
(EHT/TN/A/41; HTS/73/14) Avail: NTIS HC $3.00

Measurements are reported of the mean and rms axial component of velocity in a 4 inch square duct in which premixed propane-air flames were stabilized on two V-shaped gutters transverse to the flow. The measurements were obtained with a laser anemometer and included profiles normal to the duct center line and in the vicinity of the gutters. The profile obtained 6.4 mm upstream of the plane of the gutter lip exhibited few surprises but that obtained in the plane of the gutter lip revealed a velocity maximum and was clearly influenced by the separation region behind the gutter. The measurements in the plane of the lip were obtained with and without buzz. The mean-velocity values were uninfluenced by buzz but the rms-values were significantly increased. Measurements in the flame downstream of a gutter confirmed the possibility of seeding the flame with titanium dioxide particles and of measuring the resulting signal. As expected, the signal spectra broadened rapidly as the measuring control volume was traversed towards the gutter from a downstream location. The indicated length of the separation region was approximately three gutter widths. These results were obtained using a frequency analyzer to process the signal from the photomultiplier. Preliminary experiments-with a frequency-tracking demodulator and a computing counter suggested that the former was unlikely to be of use in buzz conditions but that the latter is likely to prove of value.
Author

N74-12047# Imperial Coll. of Science and Technology, London (England).
THE TREATMENT IN THE THREE-DIMENSIONAL BOUNDARY-LAYER PROGRAM OF WALLS WHICH DO NOT PASS THROUGH GRID NODES

J. J. McGuirk and D. B. Spalding Mar. 1973 22 p refs
(HTS/73/13) Avail: NTIS HC $3.25

The modifications are described which were made to an existing computer program so that it can handle flows in ducts with nonrectangular boundaries. As an example of its use, predictions are presented for laminar flow in a circular tube; both uniform and nonuniform inlet conditions are considered.
Author

N74-12048# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
THE TURBULENT BOUNDARY LAYER WITH FOREIGN GAS INJECTION. 2: PREDICTIONS AND MEASUREMENTS IN SEVERE STREAMWISE PRESSURE GRADIENTS

R. J. Baker and B. E. Launder Jan. 1973 46 p refs
(BL/TN/A/59; HTS/73/6) Avail: NTIS HC $4.50

A new version is proposed of the Prandtl mixing length hypothesis for flow past smooth surfaces. The model is used in obtaining extensive predictions of boundary layers on porous surfaces including flows with steep density and pressure gradients. Very good agreement of predictions with measurements is obtained except in flows in adverse pressure gradients and under conditions of high blowing. In these cases the level of mixing length in the outer part of the boundary layer does not increase as fast as the boundary layer thickness; consequently the true value of Lambda fails.
Author

N74-12049# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
INSTANTANEOUS VELOCITY AND TEMPERATURE MEASUREMENTS IN OSCILLATING DIFFUSION FLAMES
D. F. G. Durao and J. H. Whitelaw Apr. 1973 63 p refs
(ET/TN/A/23; HTS/73/8) Avail: NTIS HC $5.25

Measurements of instantaneous velocity, instantaneous temperature, and the corresponding mean and rms values, obtained in a range of diffusion flames, are presented. The velocity measurements were obtained with a laser anemometer and the temperature measurements with a thermocouple. The flames were formed by burning methane, town gas and hydrogen at the exit from burner tubes. All flames exhibited discrete frequencies in the vicinity of 11 Hz. The instanteous velocity and temperature signals were close to sinusoidal, except in the vicinity of the reaction zone where double frequencies and spiky signals were observed. The rms temperature distributions exhibited minima in the region of the maximum values of mean temperature; the rms velocity distributions were similar in form but the location of the minimum occurred downstream of the corresponding rms temperature minimum. A flame model is postulated and shown to represent the many observed features of the oscillating flames. It appears that the oscillations stem from aerodynamic instabilities associated with inflection points in the local, instantaneous velocity distributions. Author

N74-12050# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
DISCRETE HOLE COOLING IN THE PRESENCE OF FREE STREAM TURBULENCE AND STRONG FAVOURABLE PRESSURE GRADIENT
B. E. Launder and J. York Jan. 1973 20 p refs
(EHT/TN/A/41; HTS/73/9) Avail: NTIS HC $3.00

The influence was investigated of both free-stream acceleration, and free-stream turbulence, employing as test plate the most successful geometries examined in a recent survey. The principal measurement for assessing the cooling performance has been the concentration of the injectant on the plate surface. Profiles of mean streamwise velocity close to the plate were measured at a number of positions to establish the hydrodynamic character of the flow. A brief description of apparatus and instrumentation is provided along with an examination and discussion of the experimental findings. Author

N74-12051# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
PREDICTION OF TURBULENT FLOW IN ANNULAR DUCTS WITH DIFFERENTIAL TRANSPORT MODEL OF TURBULENCE
K. Hanjalic Dec. 1972 29 p refs
(HTS/73/37) Avail: NTIS HC $3.50

Predictions are given based on a model in which differential transport equations are solved for the turbulent shear stress, the turbulent kinetic energy, and the rate of the turbulence energy dissipation simultaneously with the mean momentum equation. The complete model consists of a closed set of four coupled non-linear partial differential equations. Predictions of flow in annuli with both smooth and rough cores with various radius ratios display in all cases very good agreement with experimental results. Author

N74-12052# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
A COMPUTING PROCEDURE FOR ONE-DIMENSIONAL, PLANE, LAMINAR, PREMIXED FLAMES
P. L. Stephenson May 1973 44 p refs
(HTS/73/26) Avail: NTIS HC $4.25

A computer program, based on the boundary layer program, description is given that has been developed to predict one demensional, plane, laminar, premixed flames. Author

N74-12053# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
LOW REYNOLDS NUMBER FLOW OVER A PLANE: SYMMETRICAL SUDDEN EXPANSION
F. Durst, A. Melling, and J. H. Whitelaw Mar. 1973 34 p refs
(HTS/73/32) Avail: NTIS HC $3.75

Flow visualization and laser-anemometry measurements are reported in the flow downstream of a plane, 3:1 symmetrical expansion with an aspect ratio of 9.2 downstream of the expansion. The flow was found to be markedly dependent on Reynolds number, and strongly three-dimensional even well away from the channel corners except at the lowest measurable velocities. The measurements at a Reynolds number of 56 indicated that the two separation regions behind the steps were of equal length. Symmetric velocity profiles existed from the expansion to a fully-developed, parabolic profile far downstream, although there were substantial three-dimensional effects in the vicinity of the separation regions. The velocity profiles were in good agreement with those obtained by solving the two-dimensional momentum equation. At a Reynolds number of 114, two separation regions of different lengths formed, leading to asymmetric velocity profiles; three-dimensional effects were much more pronounced. Author

N74-12054# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
TURBULENCE MODELS AND THEIR EXPERIMENTAL VERIFICATION. 15. FURTHER DEVELOPMENTS AND APPLICATIONS OF TURBULENCE MODELS
B. E. Launder Apr. 1973 26 p
(HTS/73/30) Avail: NTIS HC $3.50

The development of turbulence models is discussed to show: (1) refinements to models to permit improved accuracy and greater certainty of prediction, (2) extensions of models to encompass new physical phenomena, and (3) applications of newly acquired knowledge to the calculation of turbulent flows in engineering and associated environmental problems. The effects of chemical reaction on fluctuating concentration levels are analyzed. The applications of turbulence models to heat exchangers are defined. Specific examples of nuclear reactor heat transfer, film cooled turbine blade heating, air pollution from chimneys, and the aerodynamics of structures using flow prediction techniques are reported. Author

N74-12055# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
SIMULATANEOUS PREDICTIONS OF FLOW PATTERN AND RADIATION FOR THREE-DIMENSIONAL FLAMES
S. V. Patankar and D. B. Spalding Jun. 1973 31 p
(HTS/73/39) Avail: NTIS HC $3.75

A calculation method for the three-dimensional turbulent flow in a gas-turbine combustion chamber is presented. The geometry considered involves the mixing of the streams of fuel and air in a confined space; additional air streams are used for film-cooling and dilution purposes. In addition to the equations of momentum and continuity, differential equations are solved for two turbulence quantities, for the concentrations of chemical species, and for the radiation fluxes. The flame is considered to be diffusion controlled, and the radiation is accounted for by the six-flux model. The influence of various parameters on the temperature of the combustion-chamber wall is studied. The calculations are presented to illustrate the current capability in predicting turbulent reacting flows; the outstanding tasks for the future are outlined. Author

N74-12056# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
TURBULENCE MODELS AND THEIR EXPERIMENTAL VERIFICATION. 2: TWO-EQUATION TURBULENCE MODELS - 1
B. E. Launder Apr. 1973 32 p Presented at Course on Turbulence Models and Their Exptl. Verification, London, Apr. 1973
(HTS/73/17) Avail: NTIS HC $3.75

A model to describe the characteristics of turbulent flow is presented. The properties of two dimensional boundary layers are defined. The general form of the modelm the empirical constants, and applications are described. Two advantages of the model are that a single set of constants leads to satisfactory predictions of a wide range of wall and free flows and the model is simple to use. Author

N74-12057# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

TURBULENCE MODELS AND THEIR EXPERIMENTAL VERIFICATION. 6: TWO-EQUATION TURBULENCE MODELS - 3

B. E. Launder Apr. 1973 25 p Presented at Course on Turbulence Models and Their Exptl. Verification, London, Apr. 1973

(HTS/73/21) Avail: NTIS HC $3.25

The application of a flow model for regions near walls where the turbulence Reynolds number is low is discussed. The areas in which low Reynolds number modelling is needed are identified as: (1) flow in nozzles, (2) flow with high turbulence levels past bodies, and (3) flow in pipes or channels. The mathematical models are developed and it is stated that for the boundary layer flows, the equations are still parabolic and may be solved by the Patankar-Spalding procedure. Author

N74-12058# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

TURBULENCE MODELS AND THEIR EXPERIMENTAL VERIFICATION. 4: TWO-EQUATION TURBULENCE MODELS 2

D. B. Spalding Apr. 1973 26 p

(HTS/73/19) Avail: NTIS HC $3.50

The application of a mathematical model for elliptic flows is discussed. The model depends upon the following factors: (1) convergence, (2) finite difference formulations, (3) wall functions, (4) hydrodynamic applications, and (5) heat transfer applications. It is stated that the model has been used to predict recirculating flows. Author

N74-12059# Imperial Coll. of Science and Technology, London (England). Heat Transfer Section.

[HEAT TRANSFER IN BOUNDARY LAYERS, ELLIPTIC FLOWS, TURBULENCE MODELS, AND ENGINES]

Feb. 1973 21 p refs

(HTS/73/3) Avail: NTIS HC $3.25

Summaries of research projects involving gas flow and heat transfer are presented. The subjects discussed include: (1) boundary layers, (2) elliptic flows, (3) turbulence models, (4) engine heat transfer, (5) combustion and chemical kinetics, and (6) applications of laser anemometry. Author

N74-12060# Imperial Coll. of Science and Technology, London (England).

LAMINAR PIPE FLOW DOWNSTREAM OF A 15 DEG BEND

A. D. Gosman, N. S. Vlachos, and J. H. Whitelaw Apr. 1973 26 p refs

(HTS/73/4) Avail: NTIS HC $3.50

Measured and calculated velocity values are reported for the water flow downstream of a 15 deg bend in a round tube at a Reynolds number of 300. The measurements were obtained using laser anemometry and provided detailed values of axial velocity on six diameters, 30 deg apart at a location 5D downstream of the centre of the bend: these served as iniital values for the calculation procedure. Measurements on two diameters, one in the plane of the bend and one normal to the plane of the bend, were obtained at locations corresponding to 2, 5, 10, 15 and 20 diameters downstream of the initial conditions. The calculation procedure was based on a finite-difference solution of the three-dimensional, steady, boundarylayer form of the Navier-Stokes equations and made use of the numerical algorithm of Patankar and Spalding. Author

N74-12061# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

TURBULENCE MODELS AND THEIR EXPERIMENTAL VERIFICATION. 5: VERIFICATION OF TURBULENCE MODELS WITH HOT-WIRE ANEMOMETRY

M. M. Ribeiro and J. H. Whitelaw Apr. 1973 25 p

(HTS/72/20) Avail: NTIS HC $3.25

The flow properties of a gas which can be measured by hot wire anemometry and the application for verifying turbulence models are discussed. Procedures for calibrating the hot wires are described. The analysis of the hot wire anemometer signal to obtain various parameters of flow is developed. The limitations of hot wire anemometry are explained. It is stated that the precision of mesurements of turbulent correlations may exceed ten percent and there are some aspects of turbulence models which cannot be tested by hot wire anemometry. Author

N74-12062# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

TURBULENCE MODELS AND THEIR EXPERIMENTAL VERIFICATION. 10: ALTERNATIVE MEASURING TECHNIQUES

J. H. Whitelaw Apr. 1973 26 p

(HTS/73/25) Avail: NTIS HC $3.50

Alternative optical techniques which may be used to measure the velocity and scalar properties of turbulent gas flow are discussed. The methods discussed are: (1) particle timing, (2) particle training, (3) scattered light intensity, (4) crossed beam correlation, (5) Schlieren photography, and (6) interferometry. The principles of operation are described to show the signal analysis system, the measurements available, and the potential relevance to turbulence models. Author

N74-12063# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

TURBULENCE MODELS AND THEIR EXPERIMENTAL VERIFICATION. 13: TURBULENCE MEASUREMENTS IN HIGH TEMPERATURE FLUXES

J. H. Whitelaw Apr. 1973 32 p Presented at Course on Turbulence Models and Their Exptl. Verification, London, Apr. 1973

(HTS/73/28) Avail: NTIS HC $3.75

The instrumentation for measuring high temperature flows in turbulent flames is discussed. Emphasis is placed on optical anemometry to verify the turbulent flow models. The types of instruments described are: (1) pressure probes, (2) hot-wire anemometer, (3) optical anemometer, (4) thermocouples, and (5) Raman spectroscopy. The advantages and limitations of the various systems are analyzed. It is stated that the optical anemometer appears to offer the best possibility of measuring instantaneous velocity and its correlation in high temperature flows. Author

N74-12064# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

TURBULENCE MODELS AND THEIR EXPERIMENTAL VERIFICATION. 12: TURBULENCE EFFECTS ON COMBUSTION

D. B. Spalding Apr. 1973 30 p

(HTS/73/27) Avail: NTIS HC $3.50

The effects of turbulence on combustion are discussed. The subjects investigated are: (1) the turbulent diffusion flame, (2) the confined pre-mixed flame, (3) the unconfined pre-mixed flame, and (4) the formation of air pollutants in flames. Specific applications of the theoretical data are identified. Graphs and mathematical models are included to show the characteristics of flames under various conditions. Author

N74-12065# Imperial Coll. of Science and Technology, London (England).

REVIEW OF INFORMATION SUITABLE FOR TESTING THE PREDICTION OF FLOWS IN THE VICINITY OF AFTERBURNER TYPE FLAME STABILISERS

S. B. Pope Feb. 1973 15 p refs

(HTS/73/10) Avail: NTIS HC $3.00

Experimental data suitable for testing a prediction procedure for the flow in the vicinity of afterburner type flame holders are considered. The flow situation and the prediction procedure are described. Reports of experiments containing suitable information are shown for non-reacting and reacting flows respectively. The available data for non-reacting flows are adequate for testing the procedure but those for reacting flows are insufficient for this purpose. Author

N74-12066# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

THE NUMERICAL COMPUTATIONS OF TURBULENT FLOWS

B. E. Launder and D. B. Spalding Jan. 1973 60 p refs

(HTS/73/2) Avail: NTIS HC $5.00

The problem of making numerical predictions of turbulent flow is reviewed. It advocates that computational economy, width

of applicability and physical realism are best served at present by turbulence models in which the magnitudes of two turbulence quantities, the turbulence kinetic energy K and its dissipation rate Epsilon, are calculated from transport equations solved simultaneously with those governing the mean flow behaviour. The width of applicability of the model is demonstrated by reference to numerical computations of nine substantially different kinds of turbulent flow. Author

N74-12067# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
THE PREDICTION OF AXISYMMETRICAL TURBULENT SWIRLING BOUNDARY LAYERS
M. L. Koosinlin and F. C. Lockwood Feb. 1973 39 p refs
(HTS/73/1) Avail: NTIS HC $4.00

Axisymmetrical swirling boundary layers and fully three-dimensional layers have in common a two-component shear stress. Since the former are amenable to treatment by two-dimensional computational methods, they constitute useful and economical testing terrain for advanced turbulence models. A high Reynolds number turbulence model is developed which provides algebraic equations for all six Reynolds stresses. The model and its mixing-length derivative are both employed to predict a variety of swirling boundary layers. A promising improvement in universality of predictive power is exhibited. The principal conclusion is that future research should concentrate on extending the applicability of stress turbulence models into the sublayer region since the effective-viscosity based models are least satisfactory there. Author

N74-12068# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
CALCULATION OF THE THREE-DIMENSIONAL BOUNDARY LAYER WITH SOLUTION OF ALL THREE MOMENTUM EQUATIONS
S. V. Patankar, D. Rafiinejad, and D. B. Spalding Apr. 1973 23 p refs
(HTS/73/5) Avail: NTIS HC $3.00

The application of a calculation procedure to three flow situations which can be characterised as three-dimensional boundary layers is described. The procedure solves all momentum equations and takes full account of the pressure variation in directions normal to the main-flow direction. The applications demonstrate that, when the boundary conditions exhibit certain discontinuities, only the solution of all three momentum equations can give satisfactory accuracy. The results of the present calculations are compared with available similarity solutions wherever possible. Author

N74-12069# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
TURBULENCE MODELS AND THEIR EXPERIMENTAL VERIFICATION. 3: NUMERICAL SOLUTION OF THE DIFFERENTIAL EQUATIONS
D. B. Spalding Apr. 1973 30 p
(HTS/73/18) Avail: NTIS HC $3.50

Procedures for solving differential equations for three dimensional and two dimensional parabolic and elliptic flows are discussed. The nature of the differential equations is described. The four processes which must be in balance are identified as: (1) variation with time within the control volume, (2) inflow and outflow by bulk motion, (3) inflow and outflow by diffusion, and (4) creation and destruction within the control volume. Tables of data are included to show the classifications of differential equations for various types of flow. Author

N74-12070# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
PREDICTION OF LAMINAR FLOW AND HEAT TRANSFER IN HELICALLY-COILED PIPES
S. V. Patankar, V. S. Pratap, and D. B. Spalding Feb. 1973 32 p refs
(HTS/73/12) Avail: NTIS HC $3.75

A calculation procedure for three-dimensional parabolic flows is applied to predict the velocity and temperature fields in helicallycoiled pipes. The curvature produces a secondary flow and causes departures from the symmetrical velocity profile of Poiseuille flow. Predictions are presented of flow and heat transfer in the developing and fully-developed regions. Comparisons of the developing and fully-developed velocity profiles exhibit good agreement with experimental data. The development of wall temperature for the case of axially uniform heat flux with isothermal periphery has been compared with experimental data and the agreement is good. Predictions for fully-developed temperature profiles and heat-transfer coefficients also exhibit good agreement with experimental data. Effects of Dean number on friction factor and heat transfer are presented. Author

N74-12071# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
PREDICTION OF REACTION RATES IN TURBULENT PRE-MIXED BOUNDARY-LAYER FLOWS
H. B. Mason and D. B. Spalding Feb. 1973 7 p refs
(HTS/73/11) Avail: NTIS HC $3.00

A method for calculating the rate of spread of flames through a turbulent combustible gas is presented. One approach is to solve the differential equations governing the flow, using mathematical models for the interaction of turbulence with the time-mean hydrodynamics and the rate of chemical reaction. It is stated that the eddy-break-up model is capable of predicting the spread of turbulent flames behind baffles. Author

N74-12072# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
TURBULENCE MODELS AND THEIR EXPERIMENTAL VERIFICATION. 1: INTRODUCTION PLUS BIBLIOGRAPHY AND NOMENCLATURE FOR ALL FIFTEEN LECTURES
D. B. Spalding Apr. 1973 23 p refs
(HTS/72/16) Avail: NTIS HC $3.25

The development and application of turbulent flow models are discussed. Diagrams of various turbulent flow conditions are presented. Theoretical prediction procedures are developed to include (1) empirical data correlations, (2) analytical solution of simplified equations, (3) numerical solution of full equations of motion, and (4) numerical solution of time-averaged equations. It is stated that the two-equation models are best suited for analyzing hydrodynamic problems. Author

N74-12073# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
PREDICTION OF THE INFLUENCE OF TURBULENT FLUCTUATIONS ON FLOW AND HEAT TRANSFER IN FURNACES
A. D. Gosman and F. C. Lockwood Aug. 1973 11 p refs Presented at Intern. Seminar on Heat Transfer from Flames, Trogir, Yugoslavia
(HTS/73/52) Avail: NTIS HC $3.00

A computational procedure for the convective and diffusive transport, chemical reaction, and radiative exchange for two dimensional furnace flows is applied to prediction of the MI trials of the International Flame Research Foundation. Particular attention is given to the influence of the turbulence fluctuations on the distribution of temperature and the radiation fluxes. Author

N74-12074# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
MEASUREMENTS IN TURBULENT WATER FLOWS BY LASER ANEMOMETRY
A. Melling and J. H. Whitelaw Jul. 1973 42 p refs Submitted for publication
(HTS/73/44) Avail: NTIS HC $4.25

Measurements of the mean and rms values of the longitudinal velocity in a rectangular duct are reported. These results were obtained in a water flow using a laser anemometer. The important design criteria which facilitated the measurements are described and gradient, transit time, noise and refractive index corrections are specifically discussed. The results demonstrate the development of a rectangular duct flow and, in particular, reveal that a small lack of symmetry at the duct entrance can readily be identified in the normal stress results, 37 hydraulic diameters downstream. The possibility of utilizing water droplets in steam and gas bubbles in water to scatter light and thereby to assist laser-anemometer studies of turbulence is discussed. Author

N74-12075# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
A PREDICTION PROCEDURE FOR SUPERSONIC FREE SHEAR LAYERS
R. I. Issa and F. C. Lockwood Jul. 1973 16 p refs Presented at Joint Meeting of Heat and Mass Transfer and Hypersonics, Subcomm. of the ARC, London, Jul. 1973
(HTS/73/43) Avail: NTIS HC $3.00

A new method for the computation of shear layers is described which attempts to realize the advantages of both the characteristics and finite difference technique without incurring the disadvantages of either. The basis for the method is the implicit finite difference procedure for boundary layer flows. New computations are incorporated into this method in order to determine the pressure variations at each stage in the integration. These new computations are based on a hybrid method in which characteristics are superimposed on the orthogonal grid employed by the boundary layer procedure. Author

N74-12076# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
A PREDICTION PROCEDURE FOR FLOW, COMBUSTION AND HEAT TRANSFER CLOSE TO THE BASE OF A ROCKET
D. B. Spalding and D. G. Tatchell Jul. 1973 19 p refs
(HTS/73/42) Avail: NTIS HC $3.00

A calculation procedure is described for the steady, turbulent, partially recirculating flow caused by the mixing of the supersonic exhaust gases from a rocket with the subsonic or supersonic flow of air through which the rocket is moving. Chemical reaction is allowed to take place. Two numerical examples are supplied. Author

N74-12077# Imperial Coll. of Science and Technology, London (England).
AN EXPERIMENTAL AND THEORETICAL STUDY OF THE TURBULENT MIXING IN A CYLINDRICAL, GAS-FIRED FURNACE
F. M. El-Mahallawy, F. C. Lockwood, and D. B. Spalding Sep. 1973 6 p refs Presented at European Symp. of the Combust. Inst., Sheffield, Sep. 1973
(HTS/73/41) Avail: NTIS HC $3.00

An experimental study was made of a cylindrical gas fired furnace. Town gas was used as fuel and the furnace was large enough to ensure turbulent flow. Measurements of the mixture fraction were made for a variety of burner flow conditions. Some experimental results are presented. Predictions obtained using a simple turbulence model are also included. Author

N74-12078# Imperial Coll. of Science and Technology, London (England).
MEASUREMENTS OF MEAN, ROOT-MEAN-SQUARE, AND ENERGY SPECTRUM OF FLUCTUATING TEMPERATURE IN A ROUND FREE, TURBULENT DIFFUSION FLAME
F. C. Lockwood and A. O. Odidi Sep. 1973 7 p refs Presented at European Symp. of the Combust. Inst., Sheffield, England, Sep. 1973
(HTS/73/40) Avail: NTIS HC $3.00

An experimental program was conducted to provide the fluctuating quantities in reacting turbulent flows. Quantities measured are: the time-mean and fluctuating components of temperature and velocity; the probability and frequency of chemical reactions; and time-mean concentrations of stable species. The measurements of the mean, the root mean square, and the energy spectrum of fluctuating temperature were made and are summarized in the present paper. Author

N74-12079# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
A GENERAL COMPUTER PROGRAM FOR TWO-DIMENSIONAL BOUNDARY-LAYER PROBLEMS
D. B. Spalding Sep. 1973 158 p refs
(HTS/73/48) Avail: NTIS HC $10.00

A program is presented capable of predicting laminar and turbulent steady flows, with and without chemical reaction. The boundary layer may be a jet in freely moving surroundings, a layer adjacent to a solid wall, a flow wholly confined in a duct, or some combination of these flow types. A listing of the program is supplied in the form of one basic program and nine up-date programs. Author

N74-12080# Helsinki Univ. of Technology, Otaniemi (Finland).
FLOW OF A MEDIUM UNDER COMPRESSION WITH CONSIDERATION OF THE REALITY OF THE MEDIUM [PURISTUVAN VALIAINEEN VIRTAUS KUN VALIAINEEN REAALISUUS OTETAAN HUOMIOON]
Nils-Erik Fagerholm 1973 19 p refs In FINNISH
(Research-Paper-44) Avail: NTIS HC $3.00

Formulas are derived, which describe changes in pressure and flow speed in a stationary unidimensional flow where heat transfer, losses of friction and changes in surface cross section may occur. It is shown that the formulas can be put in the same form as those with the application of the ideal gas equation. Substance properties which describe the process of the course taken by the medium appear as characteristic parameters. A description is also given of how changes in temperature, density and enthalpy can be determined. As special cases, both frictional adiabatic flow without heat transfer and the effect of pure heat transfer without friction were considered. In these formulas, deviations from ideal gas space are very apparent. Author

N74-12081# Sandia Labs., Livermore, Calif.
CENTERLINE VELOCITY DECAY OF COMPRESSIBLE FREE JETS
Peter O. Witze Aug. 1973 39 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in April 1974
(Contract AT(29-1)-789)
(SLL-73-5280) Avail: NTIS HC $4.00 CSCL 20D

A new formulation for the eddy viscosity is introduced into the turbulent axially symmetric compressible free jet theory of Kleinstein. The analysis gives excellent agreement with an extensive compilation of experimental data for the centerline velocity decay in the main region. It is shown that the eddy viscosity can be treated as constant, with functional dependence on only the exit Mach number and the jet-to-freestream density ratio. The theory presented is applicable to the main region of most classes of free jets, including heterogeneous, nonisothermal, and subsonic and properly-expanded supersonic flows. Author

N74-12082*# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
FLOW IN A POROUS NOZZLE WITH MASSIVE WALL INJECTION
R. B. Kinney Aug. 1973 69 p refs
(Grant NGR-03-002-213)
(NASA-CR-134504) Avail: NTIS HC $5.50 CSCL 20D

An analytical and experimental investigation has been conducted to determine the effect of massive wall injection on the flow characteristics in a nozzle. The experiments were performed on a water table with a porous-nozzle test section. This had 45 deg and 15 deg half angles of convergence and divergence, respectively, throat radius of 2.5 inches, and throat width of 3 inches. The hydraulic analogy was employed to qualitatively extend the results to a compressible gas flow through the nozzle. An analysis of the water table flow was made using a one-dimensional flow assumption in the continuity and momentum equations. An analysis of a compressible flow in a nozzle was made in a manner analogous to that for the water flow. It is shown that the effect of blowing is to move the sonic position downstream of the geometric throat. Similar results were determined for the incompressible water table flow. Limited photographic results are presented for an injection of air, CO2, and Freon-12 into a main-stream air flow in a convergent-divergent nozzle. Schlieren photographs were used to visualize the flow. Author

N74-12083*# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
THE DESIGN OF A RESEARCH WATER TABLE
R. L. Fike, R. B. Kinney, and H. C. Perkins Aug. 1973 23 p refs
(Grant NGR-03-002-213)
(NASA-CR-121255) Avail: NTIS HC $3.25 CSCL 20D

A complete design for a research water table is presented. Following a brief discussion of the analogy between water and

compressible-gas flows (hydraulic analogy), the components of the water table and their function are described. The major design considerations are discussed, and the final design is presented.
Author

N74-12084*# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
FLOW VISUALIZATION EXPERIMENTS IN A POROUS NOZZLE
Z. Cielak, R. B. Kinney, and H. C. Perkins Aug. 1973 32 p refs
(Grant NGR-03-002-213)
(NASA-CR-121256) Avail: NTIS HC $3.75 CSCL 20D

An experimental approach is described for the study of nozzle flows with large wall-transpiration rates. Emphasizing a qualitative understanding of the flow, the technique uses the hydraulic analogy, whereby a compressible gas flow is simulated by a water flow having a free surface. For simplicity, the simulated gas flow is taken to be two-dimensional. A nozzle with porous walls in the throat region has been developed for use on a water table. A technique for visualizing the transpired fluid has also been devised. These are discussed, and preliminary results are presented which illustrate the success of the experimental approach.
Author

N74-12085*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF THE INJECTION OF A HEATED TURBULENT JET INTO A CROSS FLOW
James F. Campbell (Va. Polytechnic Inst. and State Univ.) and Joseph A. Schetz (Va. Polytechnic Inst. and State Univ.) Washington Dec. 1973 65 p refs
(NASA-TR-R-413; L-8987) Avail: NTIS HC $3.50 CSCL 20D

The development of a theoretical model is investigated of the incompressible jet injection process. The discharge of a turbulent jet into a cross flow was mathematically modeled by using an integral method which accounts for natural fluid mechanisms such as turbulence, entrainment, buoyancy, and heat transfer. The analytical results are supported by experimental data and demonstrate the usefulness of the theory for estimating the trajectory and flow properties of the jet for a variety of injection conditions. The capability of predicting jet flow properties, as well as two- and three-dimensional jet paths, was enhanced by obtaining the jet cross-sectional area during the solution of the conservation equations. Realistic estimates of temperature in the jet fluid were acquired by accounting for heat losses in the jet flow due to forced convection and to entrainment of free-stream fluid into the jet.
Author

N74-12086*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DRAG CHARACTERISTICS OF CIRCULAR CYLINDERS IN A LAMINAR BOUNDARY LAYER AT SUPERSONIC FREE-STREAM VELOCITIES
Robert L. Stallings, Jr., Milton Lamb, and Dorothy T. Howell Washington Dec. 1973 45 p refs
(NASA-TN-D-7369; L-9021) Avail: NTIS HC $3.00 CSCL 20D

Drag measurements were obtained with circular cylinders attached to a flat-plate surface with their longitudinal axes perpendicular to the plate surface. When more than one cylinder was tested, they were alined in a spanwise row perpendicular to the free-stream velocity vector. The drag measurements were obtained through a range of Mach numbers from 2.3 to 4.6, cylinder heights ranging from approximately 0.4 to 3 times the undisturbed laminar boundary-layer thickness, and cylinder height-to-diameter ratios of 1.0 and approximately 2. Included in the paper is a complete presentation in figure form of the experimental results and a discussion of the more significant findings. An attempt is made to select the most appropriate parameters for correlating the experimental results and, where possible, these results are compared with theoretical calculations.
Author

N74-12087*# Scripta Publishing Corp., Washington, D.C.
DETERMINING THE MOVEMENT OF A LIQUID FOR A CONDITION SPECIFIED ON A STREAMLINE
N. Ye. Zhukovskiy NASA Dec. 1973 15 p refs Transl. into ENGLISH from Zh. Obshch. Khim (Moscow), v. 23, no. 2, c. 1890 p 89-100
(Contract NASw-2484)
(NASA-TT-F-15207) Avail: NTIS HC $3.00 CSCL 20D

A treatment of some problems concerning liquid streamlining. Mathematical treatment of selected problems giving optimum solutions for free jet canals and for determining the width and length of such a canal under specified conditions. Consideration of the possible application of this method to other similar problems.
Author

N74-12088*# IIT Research Inst., Chicago, Ill. Engineering Mechanics Div.
SCATTERING FROM CONDENSATES IN TURBULENT JETS Final Report
L. N. Wilson and R. S. Dennen 28 Apr. 1970 35 p refs
(Contract NAS8-21035)
(NASA-CR-129015, J6112-Pt-3) Avail: NTIS HC $3.75 CSCL 20D

An analysis is made of the scattering signal levels to be expected from condensed water vapor droplets for crossed-beam instruments operating in the wavelength region. 18 to 4.3 microns. The results show that scattering should not present a problem for the infrared system operating under conditions typical of the IITRI jet facility. Actual measurements made for comparison indicate that scattering levels are appreciable, and presumably result from oil mist added by the facility air compressors.
Author

N74-12089*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEAN FLOW AND TURBULENCE MEASUREMENTS IN A MACH 5 FREE SHEAR LAYER
Richard D. Wagner Washington Dec. 1973 31 p refs
(NASA-TN-D-7366; L-9007) Avail: NTIS HC $3.00 CSCL 20D

A study of the time-averaged mean flow and the turbulence in a Mach 5 free turbulent shear layer has been performed. When the experimental data were reduced with the assumption of constant static pressure through the shear layer, the mean-velocity profile in similarity coordinates was in good agreement with the low speed velocity profile. The intensities of the velocity fluctuations were about a factor of 2 lower than the low speed measurements but with the maximum velocity fluctuations occurring in the same regions of the supersonic and low speed shear layers. A large density fluctuation was observed in the outer part of the shear layer near the boundary of the shear layer and the potential core.
Author

N74-12090*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPUTER PROGRAM FOR CALCULATING THE PERFECT GAS INVISCID FLOW FIELD ABOUT BLUNT AXISYMMETRIC BODIES AT AN ANGLE OF ATTACK OF 0 DEG
Ernest V. Zoby and Randolph A. Graves, Jr. Washington Dec. 1973 58 p refs
(NASA-TM-X-2843; L-8944) Avail: NTIS HC $3.50 CSCL 20D

A method for the rapid calculation of the inviscid shock layer about blunt axisymmetric bodies at an angle of attack of 0 deg has been developed. The procedure is of an inverse nature, that is, a shock wave is assumed and calculations proceed along rays normal to the shock. The solution is iterated until the given body is computed. The flow field solution procedure is programed at the Langley Research Center for the Control Data 6600 computer. The geometries specified in the program are spheres, ellipsoids, paraboloids, and hyperboloids which may conical afterbodies. The normal momentum equation is replaced with an approximate algebraic expression. This simplification significantly reduces machine computation time. Comparisons of the present results with shock shapes and surface pressure distributions obtained by the more exact methods indicate that the program provides reasonably accurate results for smooth bodies in axisymmetric flow. However, further research is required to establish the proper approximate form of the normal momentum equation for the two-dimensional case.
Author

N74-12091*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OFF-CENTER-LINE SHOCK INTERFERENCE HEATING PATTERNS ON BASIC SHAPES IN HYPERSONIC FLOWS
J. Wayne Keyes Washington Dec. 1973 96 p refs
(NASA-TM-X-2866; L-8942) Avail: NTIS HC $3.75 CSCL 20D

The results of an experimental study of off-center-line shock-interference heating on basic shapes at hypersonic speeds are presented. The study covered three types of shock-interference patterns over a range of nominal Mach numbers (6 to 20), specific heat ratios (1.40 and 1.67), free-stream Reynolds numbers(8 million to 26 million per meter), and impinging shock strengths. Heat-transfer rates higher than stagnation levels were measured over much of the off-center-line model surface. Peak heating up to 17 times the stagnation heating was measured.
Author

N74-12092*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASURED PRESSURE DISTRIBUTIONS OF LARGE-ANGLE CONES IN HYPERSONIC FLOWS OF TETRAFLUOROMETHANE, AIR, AND HELIUM
Robert A. Jones and James L. Hunt Washington Dec. 1973 60 p refs
(NASA-TN-D-7429; L-8834) Avail: NTIS HC $3.50 CSCL 20D

An experimental study of surface pressure distributions on a family of blunt and sharp large angle cones was made in hypersonic flows of helium, air, and tetrafluoromethane. The effective isentropic exponents of these flows were 1.67, 1.40, and 1.12. Thus, the effect of large shock density ratios such as might be encountered during planetary entry because of real-gas effects could be studied by comparing results in tetrafluoromethane with those in air and helium. It was found that shock density ratio had a large effect on both shock shape and pressure distribution. The differences in pressure distribution indicate that for atmospheric flight at high speed where real-gas effects produce large shock density ratios, large-angle cone vehicles can be expected to experience different trim angles of attack, drag coefficient, and lift-drag ratios than those for ground tests in air wind tunnels.
Author

N74-12093# Loughborough Univ. of Technology (England). Dept. of Mathematics.
NEAR ALIGNED HYPERSONIC MAGNETOHYDRODYNAMIC FLOW PAST BODIES
R. Smith Aug. 1973 26 p refs
(Mathematics-Research-27) Avail: NTIS HC $3.50

The problem of two dimensional inviscid hypersonic flow past nonconducting bodies in the presence of near aligned magnetic fields is considered. The flow is assumed to be nonrelatavistic with no energy gain from external sources and to be perfectly conducting throughout. Shock waves form ahead of the obstacle and may be either attached or detached depending on whether or not the body has a pointed or smooth nose. Efforts were made to find a solution in the case of attached shocks, for a more general kind of body than a wedge and in the case of detached shocks to consider cases where the magnetic terms can have a first order effect. The solution to the latter problem was determined only for the case of aligned flows.
Author

N74-12094# Minnesota Univ., Minneapolis. Particle Technology Lab.
FLUID MECHANICS OF THE LAMINAR FLOW AEROSOL IMPACTOR
V. A. Marple, B. Y. H. Liv, and K. T. Whitby Mar. 1973 30 p refs Presented at the Joint Meeting on Fluids Eng. and Appl. Mech. Div., Atlanta, 20 Jun. 1973
(COO-1248-35; Conf-730607-2) Avail: NTIS HC $3.50

A study has been made of the fluid mechanics of laminar flow aerosol impactors of both rectangular and round geometry. Streamlines in a rectangular impactor were obtained theoretically by solving the Navier-Stokes equations on a computer. The results were found to be in good agreement with experimentally generated streamlines in a water model using an electrolytic flow visualization technique. Further theoretical studies of the impactor using the computer solution technique showed that the flow field in the impaction region above the impaction plate is influenced only to a very limited extent by the impactor throat length while the effect due to variations in the jet-to-plate distance and the jet Reynolds number is somewhat larger. The boundary layer thickness along the impaction plate was found to be nearly constant, but the thickness was dependent on the jet Reynolds number and affected to a very slight extent by the jet-to-plate distance.
Author (NSA)

N74-12095# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
TURBULENT CONDUCTIVITY IN A FLOW BETWEEN TWO PLANE PARALLEL WALLS IN A REGIME ESTABLISHED WITH A TRANSVERSE VELOCITY GRADIENT Ph.D. Thesis - Paris Univ.
J. M. Auxilien Jun. 1973 124 p refs In FRENCH
(CEA-R-4442) Avail: AEC Depository Libraries HC $8.25

Turbulent heat flow was investigated, a filament source being exposed to a planar flow under ambient conditions. A straight section formed from two separate parts having very different sizes was used to obtain the transverse velocity gradient in the channel. The experimental data concern flows having Reynold's numbers lying between 180,000 and 810,000. The turbulence laws established from the Taylor model are confirmed. The anisotropy ratio of the thermal conductivity coefficients was defined and calculated from studies of the diffusion perpendicular and parallel to the isovelocities in the central region of the planar channel. A qualitative interpretation of the experimental observations was made in terms of the secondary currents; the degree to which these currents can facilitate energy transfers in the finned exchangers is stated.
Author (NSA)

N74-12096# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
PRESSURE DROP AND INSTABILITIES IN TWO-PHASE GAS-LIQUID FLOWS
S. Fabrega Feb. 1973 59 p refs In FRENCH
(CEA-N-1641) Avail: AEC Depository Libraries HC $5.00

The methods used to predict the pressure drop occurring in two-phase flow are reported. A summary is given of the various causes of flow instability linked to the phenomenon determining this pressure drop.
NSA

N74-12097# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
CRITICAL FLOW RATES
M. Reocreux 1 May 1973 34 p refs In FRENCH
(CEA-N-1639) Avail: AEC Depository Libraries HC $3.75

Experimental and theoretical studies of critical flow rates in two-phase flows demonstrated that the fundamental problem to be resolved is that of determining the expression for the transfer terms.
NSA

N74-12098# Aerotherm Corp., Mountain View, Calif.
GENERALIZED ABLATIVE FLOW IN GAPS AND SLOTS
L. Cooper and K. E. Putz 1972 12 p refs Presented at the 8th Thermophysics Conf., Palm Springs, Calif, 16 Jul. 1973 Sponsored by AEC Prepared in part by Sandia Labs., N. Mex.
(SLA-73-5452; Conf-730716-1) Avail: NTIS HC $3.00

An analytical method of predicting the flow properties in gap regions about control surfaces of reentry vehicles was developed. The method is particularly applicable to situations involving regions containing ablating surfaces. The analysis is based on a quasi-one-dimensional compressible flow solution including the effects of area change, friction, heat transfer, mass addition, and shocks. The effects of wall roughness and boundary layer transition effects also are included. The solution technique consists of a finite-difference approximation to the equations of change.
NSA

N74-12099# Scientific Translation Service, Ann Arbor, Mich.
INFLUENCE OF THE RATIO OF AXIAL VELOCITIES UPSTREAM AND DOWNSTREAM OF THE CASCADE ON THE AERODYNAMIC COEFFICIENTS OF A PLANE COMPRESSOR CASCADE
H. Schlichting and U. Stark [1973] 24 p refs Transl. into ENGLISH from Rev. Roum. Sci. Tech., Ser. Mecan. Appl.

(Romania), v. 17, no. 3, 655-677, 1972 24 p
(K-Trans-70) Avail: NTIS HC $3.25

Theoretical and experimental investigations on the influence of the axial velocity ratio on the aerodynamic coefficients of a compressor cascade of NACA 65-(10)06 profiles are described. The Pollard-Horlock method which transforms into the Schlichting procedure in the special case of two dimensional flow was selected for the theoretical investigations. Experiments were conducted in a low-velocity cascade wind tunnel. Theoretical as well as experimental results show a considerable influence of the axial velocity ratio on the aerodynamic coefficients of the compressor cascade. The agreement between fluid deflection, pressure transformations and pressure distributions found by potential flow theory, and the corresponding experimental values proves to be satisfactory as long as marked separation remains absent.
Author (NSA)

N74-12100# Institut Franco-Allemand de Recherches, St. Louis (France).
FLOW ANALYSIS IN SHOCK TUBES [ZUR ANALYSE VON STOSSROHRSTROEMUNGEN]
F. Wecken 6 Jul. 1972 38 p refs In GERMAN
(ISL-15/72) Avail: NTIS HC $4.00

Space-time variations of the sound part of the central flow between the shock and hydrogen/air interface in hypersonic shock tubes were determined. Measurements of both the variation of pressure at five points in the tube and the space-time graphs of the shock were used. The behavior of the working gas as real gas in chemical and thermodynamical equilibrium was considered. The effect of the tube boundary layer on the central flow was analyzed, without calculating a boundary layer. The measuring equipment used does not permit accurate detection of faint pressure variations in the flow. ESRO

N74-12101# Oxford Univ. (England). Dept. of Engineering Science.
PRELIMINARY EXPERIMENTS ON A JET-FLAP HYDROFOIL
R. E. Franklin and A. B. Bailey [1972] 34 p refs
(Contract SN/1057/014/NPL)
(Rept-1067/73) Avail: NTIS HC $3.75

A two-dimensional jet flapped hydrofoil with a 16% thick cross section of elliptical form and a 90 deg jet angle is described. Tests show that its cavitation performance is better than that of a conventional hydrofoil. ESRO

N74-12102# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
COMPUTER PROGRAM FOR VIBRATIONAL NONEQUILIBRIUM EFFECTS IN EXPANDING HIGH ENTHALPHY REACTION AIR FLOWS Final Technical Report, Feb. - Sep. 1972
Sarunas S. Lazdinis Jun. 1973 42 p refs
(AF Proj. 1426)
(AD-766726; AFFDL-TR-73-25) Avail: NTIS CSCL 07/4

The report describes a computer program which couples vibrational relaxation with chemical nonequilibrium in high enthalpy nozzle expansions of reacting air. The program was developed by modifying the Lordi, Mates, and Moselle Cornel Aeronautical Laboratory nonequilibrium chemistry computer code to include the effects of finite rate vibrational equilibration. The program includes the vibrational relaxation of N2, O2, NO, and NO(-). The developed computer program will enhance the theoretical capability in ascertaining the nonequilibrium behavior of high enthalpy reacting air flows. Author (GRA)

N74-12103# Sandia Labs., Albuquerque, N.Mex.
FORMULATION OF THE THREE-DIMENSIONAL HYPERSONIC VISCOUS SHOCK-LAYER PROBLEM
J. B. Moreno Jun. 1973 57 p refs Sponsored by AEC
(SLA-73-30) Avail: NTIS HC $3.00

The governing equations, associated boundary conditions, and formulas for heat transfer and skin friction for the three-dimensional hypersonic viscous shock-layer problem are formulated. The calculation of an orthogonal curvilinear coordinate mesh for the problem is treated, and formulas for the related metric coefficients are derived. Finally, the necessary geometrical relations for handling the shock-wave calculation are presented.
Author (NSA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N74-12104 Stanford Univ., Calif.
ANALYTIC CONTINUATION OF STOKES' EXPANSION FOR GRAVITY WAVES Ph.D. Thesis
Leonard William Schwartz 1973 111 p
Avail: Univ. Microfilms Order No. 73-14972

Stokes infinitesimal wave expansion for steady plane progressive irrotational free-surface waves was extended to high order using the computer to perform the algebra. The Stokes expansion was found to be incapable of yielding the highest wave for any value of water depth since convergence is limited in all cases by a branch point some distance short of this maximum. By reformulating the problem using a different independent parameter the highest waves are obtained correctly. Series summation and analytic continuation are facilitated by the use of Pade approximants. The method is valid in principle from infinite depth to the solitary wave and solutions of high accuracy can be obtained for most values of wave height and water depth. The nature of the limiting singularity in the physical plane is discussed. An alternate expansion procedure proposed by Havelock for the computation of waves short of the highest has been reconsidered and found to be defective. Dissert. Abstr.

N74-12105 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
RECORD OF OBSERVATIONS AT SAINT JOHN'S MAGNETIC OBSERVATORY, 1970
G. A. Brown 1973 54 p refs
(M70-44/7) Copyright. Avail: Issuing Activity

A description of observatory equipment is followed by absolute magnetometer observations and adopted baseline and scale values for 1970. G.G.

N74-12106 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
RECORD OF OBSERVATIONS AT MEANOOK MAGNETIC OBSERVATORY, 1970
Anne B. Cook 1973 55 p refs
(M70-44/6) Copyright. Avail: Issuing Activity

Absolute observations were made twice a week, on the average, and baseline values for the vertical intensity were computed from the readings of the proton precision magnetometer and the earth inductor. Tables are given which show the mean values of H, D, and Z for the intervals of 60 minutes centered on the half hour. D.L.G.

N74-12107 Ohio State Univ., Columbus.
APPLICATION OF KINEMATICAL GEODESY FOR DETERMINING THE SHORT WAVE LENGTH COMPONENTS OF THE GRAVITY FIELD BY SATELLITE GRADIOMETRY Ph.D. Thesis
George Bruce Reed 1973 173 p
Avail: Univ. Microfilms Order No. 73-18944

A geodesy oriented investigation was carried out to develop a possible procedure for the use of satellite gradient measurements in obtaining gravity boundary values and to determine if gradiometry can provide, with sufficient accuracy, discrete geopotential information equivalent to harmonic degree 90. Since real data was not available, the investigation relied heavily on computer simulation experiments in the form of simulated squares solutions. Further, because of various proposals for gradiometer instrumentation which are under development, simulations were limited to two possible instrument configurations: (1) A hard-mounted system capable of sensing five independent components of the gravity gradient tensor mounted in satellite utilizing active attitude control and gradient torque stabilization; (2) A rotating system which produces a harmonic oscillating signal which can

be analyzed in terms of signal amplitude as a function of three components of the gravity gradient tensor, and which is attitude controlled by spin stabilization. Dissert. Abstr.

N74-12108 Illinois Univ., Urbana.
AN INVESTIGATION OF HF AURORAL BACKSCATTER OVER A BISTATIC PATH Ph.D. Thesis
Frederick Otto Fahlsing 1972 129 p
Avail: Univ. Microfilms Order No. 73-17201

A Wullenweber antenna array was used to record stepped-frequency ionograms over a bistatic path including an auroral reflection. Ionograms were recorded at stepped-azimuth intervals and analyzed to determine the statistical occurrence of auroral backscatter as a function of azimuth and time delay. A technique was developed to locate the reflection point from the time delay, azimuth and maximum frequency of a stepped-frequency auroral backscatter trace. Maps were constructed showing regions of maximum frequency of occurrence of HF auroral backscatter. Results show an equatorward shift of the backscatter region with increasing magnetic activity and suggest that reflecting surfaces are horizontally elongated along lines of constant magnetic inclination. Dissert. Abstr.

N74-12109 Stanford Univ., Calif.
OGO-4 SATELLITE OBSERVATIONS OF WHISTLER-MODE PROPAGATION EFFECTS ASSOCIATED WITH CAUSTICS IN THE MAGNETOSPHERE Ph.D. Thesis
Nelson Henriques Dantas 1973 158 p
Avail: Univ. Microfilms Order No. 73-14886

Whistler striations, a phenomenon observed aboard the polar orbiting OGO-4 satellite, are described and interpreted. The phenomenon is characterized either by amplitude enhancements in bands of frequencies or by a high-frequency cutoff of whistler signals received at low latitudes. The center frequency of the bands or the cutoff frequency increases or decreases as the satellite approaches the magnetic equator, giving rise to a striated visual effect on frequency-vs-time displays. The explanation for the occurrence of the striations is based on the behavior of VLF ray paths in the region of the ionosphere characterized by the so-called equatorial anomaly of electron distribution. Ray tracing studies in this case predict the presence of caustic surfaces whose properties, combined with absorption results, account for the several details associated with the striations such as: local time of occurrence, rate of change of the cutoff frequency with latitude, minimum in cutoff frequency and its day-night variation, etc. Dissert. Abstr.

N74-12110 Slovak Academy of Sciences, Bratislava (Czechoslovakia).
RESULTS OF GEOMAGNETIC OBSERVATIONS AT THE HURBANOVA GEOMAGNETIC OBSERVATORY IN 1968
1972 64 p In CZECH, RUSSIAN, and ENGLISH
Copyright. Avail: Issuing Activity

The results of geomagnetic observations made at the observatory are reported. Observed and smoothed base lines, mean hourly, mean diurnal inequality, and mean monthly and annual values of the geomagnetic elements are presented in table form. G.G.

N74-12111*# New Mexico State Bureau of Mines and Mineral Resources, Socorro.
GEOLOGIC ANALYSIS AND EVALUATION OF ERTS-A IMAGERY FOR THE STATE OF NEW MEXICO Progress Report, 14 Mar. - 29 Oct. 1973
Frank E. Kottlowski, Principal Investigator 29 Oct. 1973 12 p refs ERTS
(Contract NAS5-21861)
(E74-10008; NASA-CR-135849) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N74-12112*# Bureau of Sport Fisheries and Wildlife, Jamestown, N.D. Northern Prairie Wildlife Research Center.
UTILIZATION OF SKYLAB (EREP) SYSTEM FOR APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Monthly Progress Report, Nov. 1973
Harvey K. Nelson and Edgar A. Work, Jr., Principal Investigators (Environ. Res. Inst. of Mich.) 30 Nov. 1973 2 p EREP
(NASA Order T-4114-B)
(E74-10009; NASA-CR-135850) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N74-12113*# Army Engineer District, San Francisco, Calif.
CALIFORNIA COAST NEARSHORE PROCESSES STUDY Progress Report, 1 Sep. - 31 Oct. 1973
Douglas M. Pirie and David D. Steller, Principal Investigators (Geosource Intern., Inc., Seal Beach, Calif.) Nov. 1973 5 p ERTS
(NASA Order S-70257-AG)
(E74-10011; NASA-CR-135852; ERTS-1-1-5; PR-5) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N74-12114*# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSES UTILIZING ERTS-1 IMAGERY Progress Report, Dec. 1972 - Jun. 1973
Duwayne M. Anderson, Harlan L. McKim, Richard K. Haugen, Lawrence W. Gatto, Charles W. Slaughter, and Thomas L. Marlar, Prinicpal Investigators 23 Jun. 1973 75 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70253-AG)
(E74-10017; NASA-CR-135858) Avail: NTIS HC $5.75 CSCL 08L

The author has identified the following significant results. Physiognomic landscape features were used as geologic and vegetative indicators in preparation of a surficial geology, vegetation, and permafrost map at a scale of 1:1 million using ERTS-1 band 7 imagery. The detail from this map compared favorably with USGS maps at 1:250,000 scale. Physical boundaries mapped from ERTS-1 imagery in combination with ground truth obtained from existing small maps and other sources resulted in improved and more detailed maps of permafrost terrain and vegetation for the same area. ERTS-1 imagery provides for the first time, a means of monitoring the following regional estuarine processes: daily and periodic surface water circulation patterns; changes in the relative sediment load of rivers discharging into the inlet; and, several local patterns not recognized before, such as a clockwise back eddy offshore from Clam Gulch and a counterclockwise current north of the Forelands. Comparison of ERTS-1 and Mariner imagery has revealed that the thermokarst depressions found on the Alaskan North Slope and polygonal patterns on the Yukon River Delta are possible analogs to some Martian terrain features.

N74-12115*# Argus Exploration Co., Los Angeles, Calif.
A RECONNAISSANCE SPACE SENSING INVESTIGATION OF CRUSTAL STRUCTURE FOR A STRIP FROM THE EASTERN SIERRA NEVADA TO THE COLORADO PLATEAU Progress Report, 1 Sep. - 31 Oct. 1973
Marl Liggett, Principal Investigator 9 Nov. 1973 19 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21809)
(E74-10018; NASA-CR-135859) Avail: NTIS HC $3.00 CSCL 08E

The author has identified the following significant results. An operational technique for producing high resolution false color composites of ERTS-1 MSS imagery has been developed. The technique uses standard NASA (NDPF) or EROS black/white data products, and permits a broad range of control on composite color balance and contrast range. The use of an additive color viewer has proven valuable for determining the optimum color balance of composites for effective interpretation. The compositing technique is adaptable for effective interpretation. The technique is adaptable to data from a variety of multispectral imaging systems, including multi-seasonal and multipolarization data. A 50 mile north-trending linear anomaly recongized in ERTS-1 MSS

imagery west of Goldfield, Nevada has been confirmed as a steeply west-dipping normal fault, here termed the Paymaster Fault. This structure trends southward from the General Thomas Hills along Paymaster Valley and the east side of Clayton Valley into the Palmetto Mountains. There, it terminates against a less pronounced east-trending transverse anomaly which is also believed to be fault controlled. The Paymaster Fault is the most prominent of several large normal faults which terminate southward against this transverse anomaly.

N74-12116*# California Univ., Berkeley. Space Sciences Lab.
AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA BASED ON SKYLAB AND SUPPORTING AIRCRAFT DATA Quarterly Progress Report
Robert N. Colwell, James D. Nichols, Leonard W. Bowden, and Wes Chambers, Principal Investigators (Bureau of Land Management, Riverside, Calif.) 31 Aug. 1973 17 p EREP
(Contract NAS2-7562)
(E74-10019; NASA-CR-135860) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N74-12117*# California Univ., Riverside. Citrus Research Center/Agricultural Experiment Station.
EVALUATION OF REMOTE SENSING IN CONTROL OF PINK BOLLWORM IN COTTON Final Draft Report, Jul. 1972 - Oct. 1973
Lowell N. Lewis, Principal Investigator and Virginia B. Coleman 30 Nov. 1973 25 p ERTS
(Contract NAS5-21771)
(E74-10026; NASA-CR-135867) Avail: NTIS HC $3.25 CSCL 06C

The author has identified the following significant results. The main objective is to evaluate the use of a satellite in monitoring the cotton production regulation program of the State of California as an aid in controlling pink bollworm infestation in the southern deserts of California. Color combined images of ERTS-1 multispectral images simulating color infrared are being used for crop identification. The status of each field (i.e., crop, bare, harvested, wet, plowed) is mapped from the imagery and is then compared to ground survey information taken at the time of ERTS-1 overflights. A computer analysis has been performed to compare field and satellite data to a crop calendar. Correlation to data has been 97% for field condition. Actual crop identification varies; cotton identification is only 63% due to lack of full season coverage.

N74-12118*# Naval Research Lab., Washington, D.C.
TERRAIN PROPERTIES AND TOPOGRAPHY FROM SKYLAB ALTIMETRY Monthly Progress Report, Oct. 1973
Allan Shapiro, Principal Investigator 27 Nov. 1973 2 p EREP
(NASA Order T-4716-B)
(E74-10028; NASA-CR-135869) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N74-12119*# Eason Oil Co., Oklahoma City, Okla.
AN EVALUATION OF THE SUITABILITY OF ERTS DATA FOR THE PURPOSES OF PETROLEUM EXPLORATION Progress Report, Aug. - Sep. 1973
Robert J. Collins, Principal Investigator 28 Nov. 1973 6 p ERTS
(Contract NAS5-21735)
(E74-10029; NASA-CR-135870) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N74-12120*# Texas Technological Univ., Lubbock. Remote Sensing Lab.
DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS Progress Report, 1 Oct. - 30 Nov. 1973
C. C. Reeves, Jr., Principal Investigator 30 Nov. 1973 3 p ERTS
(Contract NAS5-21720)
(E74-10031; NASA-CR-135872) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N74-12121*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources (ORSER).
AGRICULTURAL LAND USE MAPPING Interim Report
George J. McMurtry, Gary W. Petersen, Principal Investigators, and A. D. Wilson May 1973 26 p ERTS
(Contract NAS5-23133)
(E74-10032; NASA-CR-135873; ORSER-SSEL-TR-25-73) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. Agricultural areas were selected or analysis in southeastern Pennsylvania, north central Montana, and southern Texas. These three sites represent a broad range of soils, soil parent materials, climate, modes of agricultural operation, crops, and field sizes. In each of these three sites, ERTS-1 digital data were processed to determine the feasibility of automatically mapping agricultural land use. In Pennsylvania, forest land, cultivated land, and water were separable within a 25,000 acre area. Four classes of water were also classified and identified, using ground truth. A less complex land use pattern was analyzed in Hill County, Montana. A land use map was prepared shown alternating patterns of summer fallow and stubble fields. The location of farmsteads could be inferred, along with that of a railroad line. A river and a creek flowing into the river were discernible. Six categories of water, related to sediment content and depth, were defined in the reservoir held by the Fresno dam. These classifications were completed on a 150 square mile area. Analysis of the data from Texas is in its formative stages. A test site has been selected and a brightness map has been produced.

N74-12122*# South Dakota State Univ., Brookings. Remote Sensing Inst.
[USE OF MULTISPECTRAL SYSTEMS TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL] Monthly Report, period ending 1 Oct. 1973
Victor I. Myers, Principal Investigator 1 Oct. 1973 2 p EREP
(Contract NAS9-13337)
(E74-10034; NASA-CR-135875) Avail: NTIS HC $3.00 CSCL 08M

There are no author-identified significant results in this report.

N74-12123*# North Carolina State Univ., Raleigh. Dept. of Geosciences.
UTILIZATION OF ERTS-A DATA IN GEOLOGICAL EVALUATION, REGIONAL PLANNING, FOREST MANAGEMENT, AND WATER MANAGEMENT IN NORTH CAROLINA
Charles W. Welby, Principal Investigator 30 Nov. 1973 4 p ERTS
(Contract NAS5-21732)
(E74-10035; NASA-CR-135876) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N74-12124*# California Univ., Berkeley. Space Sciences Lab.
AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA BASED ON ERTS-1 AND SUPPORTING AIRCRAFT DATA Progress Report
Robert N. Colwell, Donald T. Lauer, Robert Burgy, Gerald Schubert, John E. Estes, Leonard W. Bowden, Vidal Algazi, William E. Wildman, Gordon L. Huntington, Principal Investigators et al 31 Oct. 1973 3 p ERTS
(Contract NAS5-21827)
(E74-10036; NASA-CR-135877; PR-5) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N74-12125*# Geological Survey, Tacoma, Wash.
EVALUATE ERTS IMAGERY FOR MAPPING AND DETECTION OF CHANGES OF SNOWCOVER ON LAND AND ON GLACIERS Progress Report, 1 Sep. - 31 Oct. 1973

Mark F. Meier, Principal Investigator 31 Oct. 1973 4 p ERTS
(NASA Order S-70243-AG-2)
(E74-10037; NASA-CR-135878) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. The standard error of measurement of snow-covered areas in major drainage basins in the Cascade Range, Washington, using single measurements of ERTS-1 images, was found to range from 11% to 7% during a typical melt season, but was as high as 32% in midwinter. Many dangerous glacier situations in Alaska, Yukon, and British Columbia were observed on ERTS-1 imagery. Glacier dammed lakes in Alaska are being monitored by ERTS-1. Embayments in tidal glaciers show changes detectable by ERTS-1. Surges of Russell and Tweedsmuir Glaciers, now in progress, are clearly visible. The Tweedsmuir surge is likely to dam the large Alsek River by mid-November, producing major floods down-river next summer. An ERTS-1 image of the Pamir Mountains, Tadjik S.S.R., shows the surging Medvezhii (Bear) Glacier just after its surge of early summer which dammed the Abdukagor Valley creating a huge lake and later a flood in the populous Vanch River Valley. A map was compiled from an ERTS-1 image of the Lowell Glacier after its recent surge, compared with an earlier map compiled from pain-stakingly compiled from a mosaic of many aerial photographs, in a total elapsed time of 1.5 hours. This demonstrates the value of ERTS-1 for rapid mapping of large features.

N74-12126*# Geological Survey, Reston, Va.
DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO Progress Report, 1 Sep. - 31 Oct. 1973
Edward J. Pluhowski, Principal Investigator 1 Nov. 1973 3 p ERTS
(NASA Order S-70243-AG-2)
(E74-10038; NASA-CR-135879) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. An extensive clear-water plume emanating at the mouth of the Niagara River was detected on imagery obtained September 3, 1973 (frame no. 1407-15343). This plume (area over 500 sq. km.), which appears darker than the surrounding lake waters, extended 30 km offshore, or more than 60% across the width of the lake. The plume was 20 km across at its widest point. This plume is, by far, the largest generated by the Niagara River as viewed from the ERTS-1 satellite. A combination of high background lake turbidity relative to that of the Niagara River and gentle offshore (southerly) winds produced the well-defined turbidity feature.

N74-12127*# Bureau of Sport Fisheries and Wildlife, Jamestown, N.D. Northern Prairie Wildlife Research Center.
APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Progress Report, 1 Sep. - 31 Oct. 1973
Harvey K. Nelson, Principal Investigator 1 Nov. 1973 4 p ERTS
(NASA Order S-70243-AG-4)
(E74-10039; NASA-CR-135880) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N74-12128*# Bureau of Reclamation, Denver, Colo.
APPLICATION OF REMOTE SENSING TO SELECTED BUREAU OF RECLAMATION PROJECTS Progress Report, 1 Sep. - 31 Oct. 1973
Larry D. Cast, Principal Investigator 1 Nov. 1973 2 p ERTS
(NASA Order S-70243-AG)
(E74-10040; NASA-CR-135881) Avail: NTIS HC $3.00 CSCL 13B

There are no author-identified significant results in this report.

N74-12129*# Geological Survey, Washington, D.C.
LAND USE MAPPING AND MODELLING FOR THE PHOENIX QUADRANGLE Progress Report, 1 Sep. - 31 Oct. 1973
John L. Place, Principal Investigator 1 Nov. 1973 4 p ERTS
(NASA Order S-70243-AG)
(E74-10041; NASA-CR-135882) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. In comparing the land use changes from the overlay as detected from ERTS-1 and the high altitude change overlay, total areas of change were of the same magnitude. The greatest variations were a result of differences in dates and areas of coverage between ERTS-1 images and aerial photographs. Separation of citrus from other agricultural land has been moderately successful in the ERTS-1 1:100,000 scale Level 2 land use mapping around Phoenix, although accuracy estimates are not yet available. No feeding operations have been detected from ERTS-1 so far. Preliminary indications are that commercial and services, industrial, and institutional land are not separable from each other using present image interpretation techniques. Urban open areas such as parks and golf courses are readily detectable, particularly when local maps are consulted even though out-of-date. Strip and clustered settlements may be detected depending upon their size and contrast with the surrounding area on the ERTS-1 image.

N74-12130*# Bureau of Sport Fisheries and Wildlife, Jamestown, N.D. Northern Prairie Wildlife Research Center.
UTILIZATION OF SKYLAB (EREP) SYSTEM FOR APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Monthly Progress Report, Oct. 1973
Harvey K. Nelson and Edgar A. Work, Jr., Principal Investigators (Environ. Res. Inst. of Mich.) 19 Oct. 1973 2 p EREP
(NASA Order T-4114-B)
(E74-10063; NASA-CR-135963) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N74-12131*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Quarterly Progress Report, 1 Jul. - 31 Oct. 1973
John W. Hannah, Garland L. Thomas, and Fernando Esparza, Principal Investigators 1 Nov. 1973 10 p ref Prepared in cooperation with Brevard County Planning Dept. EREP
(NASA Order CC-30281-A)
(E74-10064; NASA-TM-X-69470) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Lake Apopka and three lakes downstream of it (Dora, Eustis, and Griffin) are in an advanced state of eutrophication with high algal concentrations. This feature has shown up consistently on ERTS-1 images in the form of a characteristic water color for those lakes. As expected, EREP photographs also show a characteristic color for those lakes. What was not expected is that Lake Griffin shows a clear pattern of this coloration. Personnel familiar with the lake believe that the photograph does, indeed, show an algal bloom. It is reported that the algal concentration is often significantly higher in the southern portion of the lake. What the photograph shows that was not otherwise known is the pattern of the algal bloom. A similar, but less pronounced, effect is seen in Lake Tohopekaliga. Personnel stationed at Kissimmee reported that there was an algal bloom on that lake at the time of the EREP pass and that its extent corresponded approximately to that shown on the photograph. Again, the EREP photograph gives information about the extent of the bloom that could not be obtained practically by sampling. ERTS-1 images give some indication of this algal distribution on Lake Griffin in some cases, but are inconclusive.

N74-12132*# California Univ., Berkeley. Space Sciences Lab.
AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA BASED ON ERTS-1 AND SUPPORTING AIRCRAFT DATA, VOLUME 1 Progress Report
Robert N. Colwell, Gene A. Thorley, and Robert Burgy, Principal Investigators 31 Jul. 1973 217 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21827)
(E74-10065; NASA-CR-135823; PR-2) Avail: NTIS HC $13.00 CSCL 08F

There are no author-identified significant results in this report.

N74-12133*# California Univ., Berkeley. Space Sciences Lab.
AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA BASED ON ERTS-1 AND SUPPORTING AIRCRAFT DATA, VOLUME 2 Progress Report
Robert N. Colwell, Gerald Schubert, John E. Estes, Leonard W. Bowden, Vidal Algazi, William E. Wildman, and Gordon L. Huntington, Principal Investigators 31 Jul. 1973 236 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21827)
(E74-10066; NASA-CR-135965) Avail: NTIS HC $14.00 CSCL 08F

There are no author-identified significant results in this report.

N74-12134*# Department of Agriculture, Washington, D.C. Statistical Reporting Service.
CROP IDENTIFICATION AND ACREAGE MEASUREMENT UTILIZING ERTS IMAGERY Progress Report, 20 Aug. - 19 Oct. 1973
Donald H. VonSteen, Principal Investigator 19 Oct. 1973 19 p ERTS
(NASA Order S-70251-AG-3)
(E74-10070; NASA-CR-135819) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

N74-12135*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
IN SITU SPECTRORADIOMETRIC CALIBRATION OF EREP IMAGERY AND OCEANOGRAPHY OF BLOCK ISLAND SOUND Monthly Progress Report, Oct. 1973
Edward Yost, Principal Investigator 19 Oct. 1973 3 p EREP
(Contract NAS9-13308)
(E74-10071; NASA-CR-135818) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N74-12136*# Maine State Highway Dept., Bangor.
DETECTION AND MONITORING OF VEGETATION DAMAGE ASSOCIATED WITH HIGHWAY FACILITIES Progress Report, period ending 1 Sep. 1973
Ernest G. Stoeckeler, Principal Investigator Sep. 1973 2 p ERTS
(Contract NAS5-21724)
(E74-10076; NASA-CR-135813; PR-8) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N74-12137*# Alaska Univ., Fairbanks.
GLACIOLOGICAL AND VOLCANOLOGICAL STUDIES IN THE WRANGELL MOUNTAINS, ALASKA Bimonthly Progress Report
Carl S. Benson, Principal Investigator 30 Sep. 1973 3 p ref ERTS
(Contract NAS5-21833)
(E74-10078; NASA-CR-135747; BMPR-7) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. A field trip was made to the summit of Mt. Wrangell to verify conclusions reached by study of ERTS-1 imagery and aerial photographs. Twelve points were surveyed on the snow surface of the north crater from two primary control points established in 1961-1965 on the rim. The snow surface has dropped by about 20m in the western half of the crater since 1965. In the eastern half the settling is much greater. The total amount of ice which has melted by volcanic heat appears close to 18 x 10 to the 9th power Kg. The heat flux calculated from this estimate over the 500,000 sq m area of the crater is slightly more than 1000 microcal/sq cm/sec. It is now clear that the increase in rock area observed on ERTS-1 images is due entirely to volcanic heat.

N74-12138*# Army Engineer District, San Francisco, Calif.
CALIFORNIA COAST NEARSHORE PROCESSES STUDY Progress Report, 1 Mar. - 31 Aug. 1973
Douglas M. Pirie and David D. Steller, Principal Investigators (Rockwell International Corp., Downey, Calif.) Sep. 1973 114 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70257-AG)
(E74-10079; NASA-CR-135824) Avail: NTIS HC $7.75 CSCL 08J

The author has identified the following significant results. Large scale sediment plumes from intermittent streams and rivers form detectable seasonal patterns on ERTS-1 imagery. The ocean current systems, as plotted from three California coast ERTS mosaics, were identified. Offshore patterns of sediment in areas such as the Santa Barbara Channel are traceable. These patterns extend offshore to heretofore unanticipated ranges as shown on the ERTS-1 imagery. Flying spot scanner enhancements of NASA tapes resulted in details of subtle and often invisible (to the eye) nearshore features. The suspended sediments off San Francisco and in Monterey Bay are emphasized in detail. These are areas of extremely changeable offshore sediment transport patterns. Computer generated contouring of radiance levels resulted in maps that can be used in determining surface and nearsurface suspended sediment distribution. Tentative calibrations of ERTS-1 spectral brightness against sediment load have been made using shipboard measurements. Information from the combined enhancement and interpretation techniques is applicable to operational coastal engineering programs.

N74-12139*# Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, Oct. 1973
Richard F. Nalepka and William A. Malila, Principal Investigators 5 Nov. 1973 1 p EREP
(Contract NAS9-13280)
(E74-10084; NASA-CR-135973; ERIM-101900-17-L; MPR-8) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N74-12140*# Kansas Univ. Center for Research, Inc., Lawrence.
KANSAS ENVIRONMENTAL AND RESOURCE STUDY: A GREAT PLAINS MODEL Progress Report, Aug. - Sep. 1973
R. M. Haralick, Edward T. Kanemasu, Stanley A. Morain, Harold L. Yarger, and Fawwaz T. Ulaby, Principal Investigators Oct. 1973 38 p ERTS
(Contract NAS5-21822)
(E74-10091; NASA-CR-136003) Avail: NTIS HC $4.00 CSCL 08F

The land use category of subimage regions over Kansas within an MSS image can be identified with an accuracy of about 70% using the textural-spectral features of the multi-images from the four MSS bands. Ground truth measurements indicate that reflectance ratios of the 545 and 655 nm wavebands provide an index of plant development and possibly physiological stress. Agricultural consultants have expressed substantial interest in work conducted on center pivot irrigation and have inquired as to how they may use ERTS-1 imagery to aid those in the irrigation field. Results of the land use mapping experiment indicate that ERTS-1 imagery has major potential in regionalization. The ways in which land is utilized within these regions may then be studied more effectively than if no adequate regionalization is available.

N74-12141* Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
USE OF FEATURE EXTRACTION TECHNIQUES FOR THE TEXTURE AND CONTEXT INFORMATION IN ERTS IMAGERY
R. M. Haralick, G. L. Kelly, Principal Investigators, and Robert J. Bosley *In its* Kansas Environ. and Resource Study: A Great

Plains Model Oct. 1973 5 p ERTS (For availability see N74-12140 03-13)
(Rept-2261-7) CSCL 05B

The author has identified the following significant results. The land use category of subimage regions over Kansas within an MSS image can be identified with an accuracy of about 70% using the textural-spectral features of the multi-images from the four MSS bands.

N74-12142* Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
INTERPRETATION AND AUTOMATIC IMAGE ENHANCEMENT FACILITY
R. M. Haralick, G. L. Kelly, Principal Investigators, and Robert J. Bosley *In its* Kansas Environ. and Resource Study: A Great Plains Model Oct. 1973 5 p ERTS (For availability see N74-12140 03-13)
(Rept-2262-7) CSCL 14B

There are no author-identified significant results in this report.

N74-12143* Kansas Univ. Center for Research, Inc., Lawrence. Evapotranspiration Lab.
WHEAT: ITS WATER USE, PRODUCTION AND DISEASE DETECTION AND PREDICTION
Edward T. Kanemasu, Principal Investigator *In its* Kansas Environ. and Resource Study: A Great Plains Model Oct. 1973 5 p ERTS (For availability see N74-12140 03-13)
(Rept-2263-7) CSCL 02C

The author has identified the following significant results. Ground truth measurements indicate that reflectance ratios of the 545 and 655 mm wavebands provide an index of plant development and possibly physiological stress.

N74-12144* Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
EXTRACTION OF AGRICULTURAL STATISTICS FROM ERTS-A DATA OF KANSAS
Stanley A. Morain, Principal Investigator and Donald L. Williams *In its* Kansas Environ. and Resource Study: A Great Plains Model Oct. 1973 7 p ERTS (For availability see N74-12140 03-13)
(Rept-2264-7) CSCL 02C

The author has identified the following significant results. Agricultural consultants have expressed substantial interest in work being conducted on center pivot irrigation and have inquired as to how ERTS-1 imagery can be used to aid those in the irrigation field. Results of the land use mapping experiment indicate that ERTS-1 imagery has major potential in regionalization. The ways in which land is utilized within these regions may then be studied more effectively than if no adequate regionalization is available.

N74-12145* Kansas Univ. Center for Research, Inc., Lawrence. Kansas Geological Survey.
MONITORING FRESH WATER RESOURCES
Harold L. Yarger, Principal Investigator *In its* Kansas Environ. and Resource Study: A Great Plains Model Oct. 1973 6 p ERTS (For availability see N74-12140 03-13)
(Rept-2265-7) CSCL 08H

There are no author-identified significant results in this report.

N74-12146* Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
GROUND PATTERN ANALYSIS IN THE GREAT PLAINS
Fawwaz T. Ulaby and John C. Davis, Principal Investigators *In its* Kansas Environ. and Resource Study: A Great Plains Model Oct. 1973 7 p ERTS (For availability see N74-12140 03-13)
(Rept-2266-7) CSCL 08B

There are no author-identified significant results in this report.

N74-12147*# National Environmental Satellite Service, Washington, D.C.
EVALUATION OF ERTS DATA FOR CERTAIN OCEANOGRAPHIC USES Semiannual Report, May - Oct. 1973
Alan E. Strong, Principal Investigator Oct. 1973 8 p ERTS (NASA Order S-70246-AG)
(E74-10093; NASA-CR-136005; SAR-3) Avail: NTIS HC $3.00 CSCL 08A

The author has identified the following significant results. (1) Sunglint effects over water can be expected in ERTS-1 images whenever solar elevations exceed 55 deg. (2) Upwellings were viewed coincidently by ERTS-1 and NOAA-2 in Lake Michigan on two occasions during August 1973. (3) A large oil slick was identified 100 km off the Maryland coast in the Atlantic Ocean. Volume of the oil was estimated to be least 200,000 liters (50,000 gallons). (4) ERTS-1 observations of turbidity patterns in Lake St. Clair provide circulation information that correlates well with physical model studies made 10 years ago. (5) Good correlation has been established between ERTS-1 water color densities and NOAA-2 thermal infrared surface temperature measurements. Initial comparisons have been made in Lake Erie during March 1973.

N74-12148*# Geological Survey, Washington, D.C.
ANALYSIS STUDY OF MULTISPECTRAL DATA, ERTS-A, FROM AN AREA IN WEST PAKISTAN Progress Report, 1 Sep. - 31 Oct. 1973
Robert G. Schmidt, Principal Investigator 15 Nov. 1973 2 p ERTS
(NASA Order S-70243-AG)
(E74-10094; NASA-CR-136085) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N74-12149*# Earth Satellite Corp., Berkeley, Calif.
PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Plans and Progress Report, 1-31 Oct. 1973
Charles E. Poulton, Principal Investigator 31 Oct. 1973 7 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13286)
(E74-10095; NASA-CR-136086) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N74-12150*# California Univ., Los Angeles.
NUMERICAL SIMULATION OF THE WORLD OCEAN CIRCULATION
Kenzo Takano, Yale Mintz, and Young June Han 10 Jul. 1973 58 p refs
(Grant NGR-05-007-328)
(NASA-CR-132870) Avail: NTIS HC $5.00 CSCL 08C

A multi-level model, based on the primitive equations, is developed for simulating the temperature and velocity fields produced in the world ocean by differential heating and surface wind stress. The model ocean has constant depth, free slip at the lower boundary, and neglects momentum advection; so that there is no energy exchange between the barotropic and baroclinic components of the motion, although the former influences the latter through temperature advection. The ocean model was designed to be coupled to the UCLA atmospheric general circulation model, for the study of the dynamics of climate and climate changes. But here, the model is tested by prescribing the observed seasonally varying surface wind stress and the incident solar radiation, the surface air temperature and humidity, cloudiness and the surface wind speed, which, together with the predicted ocean surface temperature, determine the surface flux of radiant energy, sensible heat and latent heat. Author

N74-12151*# California Univ., Los Angeles. Dept. of Meteorology.
DETERMINATION OF BULK PROPERTIES OF TROPICAL CLOUD CLUSTERS FROM LARGE SCALE HEAT AND MOISTURE BUDGETS, APPENDIX B
Michio Yanai, Steven Esbensen, and Jan-Hwa Chu 29 Dec. 1972 33 p refs
(Grant NGR-05-007-328)
(NASA-CR-132871) Avail: NTIS HC $3.75 CSCL 04A

The bulk properties of tropical cloud clusters, as the vertical mass flux, the excess temperature, and moisture and the liquid water content of the clouds, are determined from a combination of the observed large-scale heat and moisture budgets over an area covering the cloud cluster, and a model of a cumulus ensemble which exchanges mass, heat, vapor and liquid water with the environment through entrainment and detrainment. The method also provides an understanding of how the environmental air is heated and moistened by the cumulus convection. An estimate of the average cloud cluster properties and the heat and moisture balance of the environment, obtained from 1956 Marshall Islands data, is presented. Author

N74-12152*# California Univ., Los Angeles. Dept. of Meteorology.
A SIMPLIFIED SCHEME FOR COMPUTING RADIATION TRANSFER IN THE TROPOSPHERE
A. Katayama 1973 79 p
(Grant NGR-05-007-328)
(NASA-CR-132873; TR-6) Avail: NTIS HC $6.00 CSCL 04A

A scheme is presented, for the heating of clear and cloudy air by solar and infrared radiation transfer, designed for use in tropospheric general circulation models with coarse vertical resolution. A bulk transmission function is defined for the infrared transfer. The interpolation factors, required for computing the bulk transmission function, are parameterized as functions of such physical parameters as the thickness of the layer, the pressure, and the mixing ratio at a reference level. The computation procedure for solar radiation is significantly simplified by the introduction of two basic concepts. The first is that the solar radiation spectrum can be divided into a scattered part, for which Rayleigh scattering is significant but absorption by water vapor is negligible, and an absorbed part for which absorption by water vapor is significant but Rayleigh scattering is negligible. The second concept is that of an equivalent cloud water vapor amount which absorbs the same amount of radiation as the cloud.
Author

N74-12153*# Dartmouth Coll., Hanover, N.H. Radiophysics Lab.
MAGNETOPAUSE STRUCTURE AND DYNAMICS OF THE MAGNETOSPHERE Final Report, 15 Apr. 1965 - 30 Jun. 1970
Bengt Sonnerup, U. O. 9 Aug. 1973 6 p
(Grant NGR-30-001-011)
(NASA-CR-136107) Avail: NTIS HC $3.00 CSCL 04A

It is shown how satellite magnetometer data at a magnetopause penetration can be used to determine the vector normal to the magnetopause current layer and the magnetic field component along this normal. Results from 22 Explorer 12 boundary penetrations indicate normal field components of less than 5 gamma in two-thirds of the cases. Measured field variations within the current layer demonstrate the existence of two fundamentally different types of boundary structure, the rotational and the tangential discontinuity. The rotational discontinuity seems to occur predominantly during magnetic storms. Finally, the calculated normal vector is compared with the normal to the surface of the Mead-Beard magnetosphere model. Author

N74-12154*# Illinois Univ., Urbana. Aeronomy Lab.
PARTIAL-REFLECTION STUDIES OF D-REGION WINTER VARIABILITY
B. W. Denny and S. A. Bowhill 1 Oct. 1973 123 p refs
(Grant NGR-14-005-181)
(NASA-CR-136129; Rept-56; UILU-Eng-73-2506) Avail: NTIS HC $8.25 CSCL 04A

D-region electron densities were measured from December, 1972, to July, 1973, at Urbana, Illinois (latitude 40.2N) using the partial-reflection technique. During the winter, electron densities at altitudes of 72, 76.5, and 81 km show cyclical changes with a period of about 5 days that are highly correlated between these altitudes, suggesting that the mechanism responsible for the winter anomaly in D-region ionization applies throughout this height region. From January 13 to February 3, a pronounced wave-like variation occurred in the partial-reflection measurements, apparently associated with a major stratospheric warming that developed in that period. During the same time period, a traveling periodic variation is observed in the 10-mb height; it is highly correlated with the partial-reflection measurements. Electron density enhancements occur approximately at the same time as increases in the 10-mb height. Comparison of A1 and A3 absorption measurements with electron density measurements below 82 km indicates that the winter anomaly in D-region ionization is divided into two types. Type 1, above about 82 km, extends horizontally for about 200 km while type 2, below about 82 km, extends for a horizontal scale of at least 1000 km. Author

N74-12155# Environmental Data Service, Boulder, Colo.
EARTHQUAKE HISTORY OF THE UNITED STATES
Jerry L. Coffman, ed. and Carl A. VonHake, ed. 1973 216 p refs Revised
(Publ-41-1-Rev) Avail: SOD HC $2.80 Domestic Postpaid or $2.50 GPO Bookstore

A history of the prominent earthquakes in the United States from historical times through 1970 is presented. Previous issues are updated and several additions and corrections are contained. A separate section is included which describes earthquakes in the Puerto Rico region. Author

N74-12156*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MODELING OF TURBULENT TRANSPORT IN THE SURFACE LAYER
G. Louis Smith Washington Dec. 1973 34 p refs
(NASA-TN-D-7306; L-8917) Avail: NTIS HC $3.00 CSCL 04A

The turbulence equations as written by Donaldson using the method of invariant modeling have been applied to the following limiting cases of the surface or constant flux layer of the planetary boundary layer: (1) Neutrally stable; (2) stable (above influence of surface roughness); (3) nearly neutrally stable; and (4) very unstable (free convection). For the neutrally stable case, the equations are shown to admit as a solution the familiar logarithmic profile. By use of this result, boundary conditions suitable for the surface layer are defined and are simple to apply to rough surfaces. Author

N74-12157*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH OBSERVATIONS FROM SPACE: OUTLOOK FOR THE GEOLOGICAL SCIENCES
Nicholas M. Short and Paul D. Lowman, Jr. Oct. 1973 119 p refs
(NASA-TM-X-70519; X-650-73-316) Avail: NTIS HC $8.00 CSCL 08G

Remote sensing from space platforms is discussed as another tool available to geologists. The results of Nimbus observations, the ERTS program, and Skylab EREP are reviewed, and a multidisciplinary approach is recommended for meeting the challenges of remote sensing. F.O.S.

N74-12158# International Geophysical Year World Data Center A, Boulder, Colo.
AURORAL ELECTROJET MAGNETIC ACTIVITY INDICES AE (11) FOR 1968
Joe Haskell Allen, Carl C. Abston, and Leslie D. Morris Asheville, N. C. Environmental Data Service Oct. 1973 149 p Sponsored by NOAA
(UAG-29) Avail: NTIS MF $1.45, National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $0.75

The Auroral Electrojet index (AE) is discussed and a detailed description is given of the derivation of 11-station 2.5-min AE indices for 1968. Tables are given of hourly average indices for each day of the year, of the stations making the main contribution to the hourly indices, and of the average monthly quiet-time level of horizontal field (H) at each magnetic observatory. Graphs of the index variations are included for each day. Author

N74-12159# Bureau of Mines, Morgantown, W.Va. Energy Research Center.
DIRECTIONAL PROPERTIES OF COAL AND THEIR UTILIZATION IN UNDERGROUND GASIFICATION EXPERIMENTS Technical Progress Report
C. A. Komar, W. K. Overbey, Jr., and J. Pasini, III Nov. 1973

14 p refs
(BM-TPR-73) Avail: NTIS HC $3.00

Renewed interest in the underground gasification of coal evolves from comprehensive studies of earth fracture systems that indicate that the movement of fluids can be controlled in the coalbed. In particular, directional property studies of natural microfissure occurrence, permeability, ultrasonic velocity, tensile strength, and orientation of intervals of inherent rock weakness, together with geologic structure setting and fracture trace analysis, can predict the gaseous flow paths in the coalbed. Having this information, the dominant direction in which gases generated and/or liberated by heat can be determined so that appropriate well patterns can be developed. Together with advances made in drilling technology that permit long horizontal holes to be drilled through the coal seams, tests can be conducted to determine whether directional control will permit devolatilization of the coalbed low-Btu gas suited for the generation of electricity. Author

N74-12160*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AEROSOL SCATTERING OF ULTRAVIOLET SUNLIGHT IN THE TROPICAL MARITIME ATMOSPHERE
A. Ghazi, A. J. Krueger, and R. S. Fraser Nov. 1973 32 p refs
(NASA-TM-X-70520; X-651-73-349) Avail: NTIS HC $3.75 CSCL 04A

The effects of atmospheric aerosol scattering on the vertical profile of solar ultraviolet radiation are investigated. Measurements of diffuse and total ultraviolet radiation were made using a rocketborne opticai sonde in the marine atmosphere of Antigua. During observations, the sun was at zenith. Vertical profiles of directly transmitted solar radiation were calculated by subtraction of the diffuse component from the total radiance. Using these values of direct downward solar UV-flux, the optical thickness of the atmosphere was derived as a function of altitude. Absorption by ozone was also considered. In the troposphere the values of observed optical thickness were in general equal to or lower than those expected theoretically from Rayleigh scattering alone. The measured radiation profiles were compared with those computed for a multiple scattering model atmosphere. Some computations regarding the interaction of UV-sunlight with maritime aerosols are presented. Author

N74-12161# Central Electricity Generating Board, London (England).
ADIABATIC ATMOSPHERIC BOUNDARY LAYERS: BIBLIOGRAPHY, 1880 - 1972
J. Counihan, comp. Sep. 1973 44 p refs
(CE-Bib-236) Avail: NTIS HC $4.25

A bibliography of 575 articles concerning atmospheric boundary layers is presented. Author

N74-12162# Geological Survey, Washington, D.C.
AN INTEGRATED SYSTEM OF GEOLOGIC MAPPING AND GEOCHEMICAL SAMPLING BY LIGHT AIRCRAFT
C. L. Sainsbury, K. J. Curry, and J. C. Hamilton 1973 32 p refs
(USGS-Bull-1361; LC-72-600230) Avail: SOD HC $0.90 Domestic Postpaid or $0.75 GPO Bookstore

Reconnaissance geologic mapping and sampling for geochemical analyses from a light aircraft were proved feasible. On the Seward Peninsula, Alaska, in areas of fair to good exposures, reconnaissance geologic maps suitable for publication at 1:250,000 scale were prepared at a rate of one 15-by 30-minute quadrangle per day, at a cost, excluding salary, of approximately $100.00 per quadrangle. Several of these maps were checked by an impartial observer from a helicopter and were found to be sufficiently accurate for reconnaissance maps. From the air, mineralized structural features, gossans, and potentially mineralized areas are easily seen, plotted, and sampled. Devices were developed by which samples of soils, sands, stream sediments, rock fragments, and humus can be collected from light aircraft. Sampling devices were developed also for use with helicopters. Use of these devices enables collection of geologic and geochemical samples from tree-covered areas, steep slopes, and tree-lined streams, which heretofore could only be sampled by long foot traverses; collection of all types of samples by helicopter is materially speeded up. Author

N74-12163# National Research Council of Canada, Ottawa (Ontario).
HEAT EXCHANGE BETWEEN PERMAFROST AND THE ATMOSPHERE IN THE PRESENCE OF A VEGETATION COVER
V. T. Balobaev 1973 20 p refs Transl. into ENGLISH from the publ. "Teplovye Protsessy y Merzlykh Gornykh Porodakh" Moscow, Nauka 1964 p 39-53
(NRC-TT-1670) Avail: NTIS HC $3.00

North American and Soviet studies of the processes involved in the formation and existence of permafrost are reviewed. Analytical material is presented pertaining to the important role of vegetation in the heat exchange between the permafrost and the atmosphere. D.L.G.

N74-12164*# Analytical Mechanics Associates, Inc., Jericho, N.Y.
ESTIMATION OF BOUNDS FOR THE GEOPOTENTIAL COEFFICIENTS
Mary H. Payne May 1973 28 p refs
(Contract NAS5-21787)
(NASA-CR-132874; Rept-73-28) Avail: NTIS HC $3.50 CSCL 08N

A numerical analysis of zonal geopotential coefficients and the bounds on the tesseral coefficients is presented. Modifications designed to incorporate data on the earth's density distribution are developed. The nature of the modifications and the application are discussed. Author

N74-12165*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A BRIEF DESCRIPTION OF AN EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS) COMPUTER DATA ANALYSIS AND MANAGEMENT PROGRAM
Robert R. Jayroe, Jr. 6 Dec. 1973 17 p refs
(NASA-TM-X-64793) Avail: NTIS HC $3.00 CSCL 05A

A data analysis and management procedure currently being used at Marshall Space Flight Center to analyze ERTS digital data is described. The objective is to acquaint potential users with the various computer programs that are available for analysis of multispectral digital imagery and to show how these programs are used in the overall data management plan. The report contains a brief description of each computer routine, and references are provided for obtaining more detailed information. Author

N74-12166*# Smithsonian Institution, Washington, D.C. Chesapeake Bay Center for Environmental Studies.
COLLECTION AND ANALYSIS OF REMOTELY SENSED DATA FROM THE RHODE RIVER ESTUARY WATERSHED
Dale W. Jenkins 1972 95 p refs Original contains color illustrations
(Contract NAS6-1913)
(NASA-CR-62097) Avail: NTIS HC $6.75 CSCL 08H

NASA chose the watershed of Rhode River, a small sub-estuary of the Bay, as a representative test area for intensive studies of remote sensing, the results of which could be extrapolated to other estuarine watersheds around the Bay. A broad program of ecological research was already underway within the watershed, conducted by the Smithsonian Institution's Chesapeake Bay Center for Environmental Studies (CBCES) and cooperating universities. This research program offered a unique opportunity to explore potential applications for remote sensing techniques. This led to a joint NASA-CBCES project with two basic objectives: to evaluate remote sensing data for the interpretation of ecological parameters, and to provide essential data for ongoing research at the CBCES. A third objective, dependent upon realization of the first two, was to extrapolate photointerpretive expertise gained at the Rhode River watershed to other portions of the Chesapeake Bay. Author

N74-12167# General Electric Co., Pittsfield, Mass. High-Voltage Lab.
LIGHTNING EFFECTS ON GENERAL AVIATION AIRCRAFT Final Report, Jan. - Sep. 1972
J. A. Plumer Oct. 1973 151 p refs

(Contract DOT-FA72NA-656)
(FAA-RD-73-99; FAA-NA-73-32) Avail: NTIS HC $9.75

To determine the actual lightning vulnerability of typical light aircraft systems and components, and demonstrate the required vulnerability assessment techniques, analyses and laboratory tests were performed on several typical light aircraft and some of their systems and components. The engineering and laboratory evaluation of component or system vulnerability is discussed. Author

N74-12168# Joint Publications Research Service, Arlington, Va.
THE FIFTH OCEAN, WATER RESOURCES OF THE ATMOSPHERE
V. Pryadko and M. Tolmachev 16 Nov. 1973 9 p Transl. into ENGLISH from Sotsialisticheskaya Industriya (USSR), 5 Aug. 1973 p 4
(JPRS-60561) Avail: NTIS HC $3.00

Hydrometeorological methods to milk clouds by crushed dry ice are reported and applications of these methods to extinguish forest fires and to clear fog away from airfields are described. Of special interest is the construction of a supermeteotron that is capable of penetrating with a heat wave an atmospheric inversion layer to form clouds in connection with vertical heat flows generated by jet engines. G.G.

N74-12169*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UPPER TROPOSPHERIC DYNAMICS AS REFLECTED IN NIMBUS-4 THIR 6.7 MICRON DATA
Edward B. Rodgers, Vincent V. Salomonson, and H. Lee Kyle Washington Dec. 1973 30 p refs
(NASA-TN-D-7493; G-7404) Avail: NTIS HC $3.00 CSCL 04A

In order to determine if a quantifiable relationship exists between the 6.7 micron radiometric patterns observed by the Nimbus-4 temperature-humidity infrared radiometer (THIR) and tropospheric dynamics, a 10-level diagnostic model is employed. The model is used to show the spatial and temporal relationships existing between radiometrically observed water vapor patterns and conventionally derived water vapor patterns, and to examine the upper and middle tropospheric water vapor budget and associated dynamics in order to assess the causes behind the spatially- and temporally-varying water vapor radiometric patterns. A particular situation involving a confluent trough located to the lee of the Rockies over the Central United States is examined. Author

N74-12170# Swedish Space Corp., Solana.
SWEDISH SOUNDING ROCKET PROGRAMME FOR THE PERIOD, 1973 - 1977
20 Sep. 1973 55 p
(S1/2-12) Avail: NTIS HC $4.75

Current plans for the Swedish national and cooperative sounding rocket activities during 1973 - 1977 are presented. The scientific activity of the Swedish space research groups covers mainly four areas: ionospheric and magnetospheric physics, atmospheric physics, astrophysics and interplanetary dust. No sounding rocket measurements are presently planned in the field of astrophysics. Author

N74-12171# Bergen Univ. (Norway). Dept. of Physics.
MORPHOLOGY AND FINE TIME STRUCTURE OF AN EARLY-MORNING ELECTRON PRECIPITATION EVENT
H. Trefall, S. Ullaland, J. Stadsnes, I. Singstad, T. Pytte, K. Bronstad, J. Bjordal, R. H. Karas (Calif. Univ., Berkeley), R. R. Brown (Calif. Univ., Berkeley), and J. Muench (Max-Planck-Inst. fuer Aeronomie, Lindau/Harz, West Germany) Oct. 1973 45 p refs
(STR-57) Avail: NTIS HC $4.25

Simultaneous balloon recordings of auroral-zone X-rays from precipitating electrons, covering a range of L-values from approximately 5 to approximately 7.5, are presented. The precipitation event occurred from about 0200 to 0500 local magnetic time, and was associated with a negative magnetic bay. Before the bay, precipitation associated with the growth phase of the substorm was observed at high L-values. After bay onset, precipitation was observed over the whole range. After bay onset, precipitation was observed over the whole range of L-values covered, but showing a delayed onset in the southern part of the precipitation region as compared with the onset of CNA-absorption in the local midnight sector. At high L-values the X-ray flux was completely unstructured and drizzle-like, both before and after bay onset. At low L-values, where precipitation occurred only after bay onset, the event was splash-like with X-ray bursts of typically 2 - 6 sec duration apparently rising out of the cosmic-ray background. Author

N74-12172# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, AUGUST 1973
Aug. 1973 44 p In ENGLISH and GERMAN
(Rept-326-F) Avail: NTIS HC $4.25

Daily summaries are presented for vertical echo sounding of the upper atmosphere during August 1973. The data include charts of median values for the E and F regions. Author

N74-12173# Ionospharen-Institut Breisach (West Germany).
IONSOPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, SEPTEMBER 1973
Sep. 1973 44 p In ENGLISH and GERMAN
(Rept-327-F) Avail: NTIS HC $4.25

For abstract, see N74-12172.

N74-12174# Sandia Labs., Albuquerque, N.Mex.
MODELING THE CHEMICAL KINETICS OF THE STRATOSPHERE
F. P Hudson Jun. 1973 49 p refs
(SC-TM-720716) Avail: NTIS HC $3.00

A tutorial development of atmospheric processes important to the chemical kinetics of the stratosphere is presented. In parallel, the mathematical simulation of the total interaction of these processes - a chemical kinetics model - is developed. The solar flux atmosphere interaction is sketched; the energy states of the oxygen molecule are discussed as an example for atmospheric molecules; the build up of a set of atmospheric species and reactions is shown stepwise; and resultant families of reactions shown. The physical mathematical foundation of the model, coupled continuity equations, is demonstrated, and examples of the types of results obtainable from calculations are given. The sample results are for a model using 33 atmospheric species composed of oxygen, nitrogen, hydrogen, and carbon atoms, with 170 chemical reactions among the species. Dissert. Abstr.

N74-12175# California Univ., Livermore. Lawrence Livermore Lab.
AQUATIC AND ATMOSPHERIC SIMULATION
J. B. Knox, D. M. Hardy, and C. A. Sherman 18 Jun. 1973 13 p refs
(Contract W-7405-eng-48)
(UCRL-51405) Avail: NTIS HC $4.00

The development of numerical simulation models of atmospheric and aquatic pollution transport, transformation, and deposition is discussed. Applications of the models in tracing air pollutants from the source to receptor are described in which a code, ADPIC, was used for computer calculations of three-dimensional particle diffusion. Other proposed applications in studies of environmental pollution include water pollution problems, waste discharge, water quality studies, sediment transport, integrated aquatic intake studies, and studies of time integrated pollution exposures in the atmosphere. (NSA)

N74-12176# Los Alamos Scientific Lab., N.Mex.
DISTRIBUTIONS AND ASSOCIATIONS OF SOME OF THE CHEMICAL ELEMENTS FOUND IN THE STRATOSPHERE
W. A. Sedlacek and P. R. Guthals 1972 4 p refs Presented at Conf. on Environ. Impact of Aerospace Operations in the High Atmos., Denver, Colo., 11 Jun. 1973
(Contract AT(29-2)-3139)
(LA-UR-73-642; Conf-730625-1) Avail: NTIS HC $3.00

Aerosols present in the lower stratosphere were collected on I.P.C. filters using USAF WB-57F aircraft. The samples were examined by neutron activation analysis, scanning electron microscopy, and chemical analysis of water-soluble material. Studies of the collection mechanisms of the samplers and

analysis of samples collected during a Sept. 1972 Lidar-Balloon-Aircraft cross-calibration experiment suggest the association of sulfate, sodium, magnesium, and chlorine with particles larger than 0.2 micrometers, and nitrate and calcium with vapors or Aitken nuclei. In addition, latitudinal iodine concentration variations were measured from 75 N to 51 S on the AEC Project Airstream sampling missions in Oct. of 1972. Although the results from one set of samples can not show what effect is contributed by seasonal variations, a curious higher concentration of iodine in the Northern mid-latitudes existed during Oct. 1972. A set of samples collected in May of 1973 should show the effect of seasonal variations. Examination of tropical upwellings and thunderstorms that penetrated the tropopause gave low iodine concentrations indicating that they are probably not principal injection mechanisms. Author (NSA)

N74-12177# Technischen Universitaet, Munich (West Germany). Inst. fuer Astronomische und Physikalische Geodaesie.

USE OF CIRA 65 AND CIRA 72 IN DETERMINING THE ORBIT OF ARTIFICIAL EARTH SATELLITES [VERWENDUNG DER ATMOSPHAERENMODELLE CIRA 65 UND CIRA 72 IN DER BAHNBESTIMMUNG GEODAETISCHER SATELLITEN]

Erich Nagel and Christoph Reigber Bonn Bundesmin. fuer Forsch. und Technol. Jun. 1973 72 p refs In GERMAN; ENGLISH summary

(Contracts WRK-132; SFB-78)

(BMFT-FBW-73-11) Avail: NTIS HC $7.75; ZLDI, Munich 14,70 DM

The Cospar International Reference Atmosphere (CIRA) 1965 and its 1972 updated version, which both review and tabulate the atmospheric structure, are applied to the determination of satellite orbits. Both models were developed from detailed analysis of atmospheric density, taking into account exosphere temperature variations due to solar activity effects, daily variations, and geomagnetic activity effects. Results of numerical integration over a five-day interval show that orbit perturbations due to air drag computer with the aid of CIRA and CIRA 1972 differ up to nearly 20% for orbital elements such as aphelion, eccentricity, inclination, and longitude of ascending mode, and up to 100% for the perigee of PEOLE, DID and GEOS B satellites. ESRO

N74-12178# Ruhr Univ., Bochum (West Germany). Abteilung fuer Physik und Astronomie.

THEORETICAL STUDIES OF THE TRANSPORT OF SOLAR RADIATION IN A REALISTIC MODEL OF THE OCEAN-ATMOSPHERE SYSTEM [THEORETISCHE STUDIEN DES TRANSPORTES SOLARER STRAHLUNG IN EINEM REALISTISCHEN MODELL DES SYSTEMS OZEAN - ATMOSPHAERE]

Ehrhard Raschke and U. Stucke Bonn Bundesmin. fuer Forsch. und Technol. Jun. 1973 98 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. (BMFT-FBW-73-13) Avail: NTIS HC $7.00; ZLDI, Munich 20,20 DM

The transfer of solar radiation in a model of the atmosphere-ocean system was considered theoretically for the purpose of satellite observations of various atmospheric and ocean properties and for determination of the radiation budget of the atmosphere. The radiative transfer equations were solved iteratively assuming anisotropical multiple scattering in both media. The contribution of aerosols, water vapor, carbon dioxide, and ozone to the atmospheric absorption was discussed, as well as the atmospheric scattering by all molecules and aerosols according to the Elterman model. In the multiple-layer model of the atmosphere-ocean system an optical depth of 10 and a rough surface for the ocean layer was assumed. The atmospheric gas absorption coefficients were derived. The spectral region under consideration ranges from 0.255 to 3.58 microns and is subdivided into 25 intervals. Radiance and radiant flux dinsities were computed for different levels. The aerosol influence on the energy budget was discussed. The aerosols cause a higher albedo of the system and up to 50% more radiative heating in the troposphere. Author (ESRO)

N74-12179# Institut Royal Meteorologique de Belgique, Brussels.

GEOPHYSICAL OBSERVATIONS Monthly Bulletin, May 1973 [OBSERVATIONS GEOPHYSIQUES. BULLETIN MENSUEL, MAI 1973]

May 1973 26 p In FRENCH and DUTCH

Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during May 1973 are presented. ESRO

N74-12180# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

ON HIGH-LATITUDE CONVECTION FIELD INHOMOGENEITIES, BIRKELAND CURRENTS AND INVERTED V PRECIPITATION EVENTS

Walter Lennartsson Jun. 1973 58 p refs Submitted for publication

(TRITA-EPP-73-11) Avail: NTIS HC $5.00

Basic principles of particle acceleration by means of electrostatic potential gradients along the geomagnetic field are discussed with emphasis on curl-free electric field configurations compatible with observed high latitude convection field reversals and inverted V precipitation events. The potential drop along the magnetic field lines was assumed to arise from some (non-specified) kind of anomalous resistivity that is induced by sufficiently intensified Birkeland currents. The inverted V shaped profile of energy versus latitude, frequently observed at the precipitation events, was found consistent with a convection profile known to occur in the low magnetosphere at high magnetic latitudes. The combined effect of the anomalous resistivity and the locally enhanced ionization due to precipitation was seen to imply a strong reduction of the convection field within an associated auroral structure. A plausible mechanism that may contact upward flowing Birkeland currents, preceding the formation of anomalous resistivity, is also discussed. Author (ESRO)

N74-12181# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

IONOSPHERE-MAGNETOSPHERE COUPLING

Rolf Bostroem Sep. 1973 26 p refs Presented at the Summer Advan. Study Inst. on Earth's Particles and Fields, Sheffield, Engl., Aug. 1973 Submitted for publication

(TRITA-EPP-73-15) Avail: NTIS HC $3.50

Some aspects of the electric coupling between the ionosphere and magnetosphere are reviewed. Topics discussed are the mapping of time-dependent electric fields, the effects of Birkeland currents on the magnetospheric plasma convection, the relation of Birkeland currents to ionospheric electric field structures such as field reversals, secondary Birkeland currents of ionospheric origin and triggering of auroral particle precipitation, double-layers causing voltage drops along the magnetic field lines, and an equivalent electric circuit for the substorm currents in the coupled inosphere-magnetosphere system. Author (ESRO)

N74-12182# Environmental Dynamics, Inc., Los Angeles, Calif.

SYNTHESIS AND EVALUATION OF URBAN-REGIONAL HYDROLOGIC RAINFALL-RUNOFF CRITERIA

John A. Dracup, Thomas J. Fogarty, and Sharon G. Grant Feb. 1973 116 p refs

(Contract DI-14-31-0001-3407)

(PB-220965/8; W73-10416) Avail: NTIS HC $3.00 CSCL 08H

Mathematical models of the hydrologic rainfall-runoff process are applied, evaluated and compared, using data from urban and natural watersheds. Criteria are developed for use in the selection of an appropriate hydrologic rainfall-runoff model for specific watershed needs. This study is oriented specifically at closing the gap between research and its application by practicing engineers and hydrologists in the water resources field. New models are not developed, but the use of existing models is clarified through a selection display tableau and user oriented computer programs implementing a wide range of rainfall-runoff models. Author (GRA)

N74-12183# Southern Methodist Univ., Dallas, Tex. Geophysical Lab.

DEVELOPMENT OF GEOTHERMAL RESERVOIRS FROM OVER-PRESSURED AREAS BENEATH THE GULF COASTAL PLAIN OF TEXAS. A FEASIBILITY STUDY OF POWER

PRODUCTION FROM OVERPRESSURED RESERVOIRS Final Report
Eugene Herrin Mar. 1973 149 p refs
(ARPA Order 2184)
(AD-766855; AFOSR-73-1344TR) Avail: NTIS CSCL 08/7

It is the purpose of the present study to determine the feasibility of locating a pilot project in the Texas Gulf Coast area for the purpose of tapping the overpressured aquifers and transforming the thermal and mechanical energy into electrical power. Three areas in south Texas were given particular attention for their feasibility of being the site of the pilot project. These are the Sebastian area in northwest Cameron County, the Port Mansfield area in eastern Willacy County, and the Corpus Christi area. GRA

N74-12184# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
HIGHLIGHTS OF RADIO ACTIVITY DURING DISK PASSAGE OF MCMATH PLAGE NO. 11976
John P. Castelli, William R. Barron, and Victor L. Badillo Jul. 1973 22 p Repr. from World Data Center A for Solar Terrest. Phys. (Colo), UAG-28-Pt-1 p 183-201
(AF Proj. 4643)
(AD-766529; AFCRL-TR-73-0499; UAG-28-Pt-1) Avail: NTIS CSCL 03/2

A number of surveys of the August 1972 period have already been generated which have presented an overview of the period (Lincoln and Leighton, 1972; McKinnon, 1972, etc.). Several of the present authors prepared a summary of the important radio activity of the period which was circulated as a personal communication to many researchers in September 1972. Later this became a comprehensive AFCRL report (Castelli et al., 1973). In this latter report, the history of the disk passage of McMath plage 11976 was traced from a radio viewpoint - principally in the dm-cm range. The report draws almost exclusively from the patrols at Sagamore Hill, Hamilton, Massachusetts, and Manila Observatory, Philippine Islands. The latter is operated under contract to the USAF. These two stations in August 1972 furnished 100% time surveillance of the radio sun. Discrete frequency activity in the 200 to 35000 MHz range and sweep frequency responses in the 24 to 48 MHz range were observed. At times, optical, ionospheric, and particle emission activity were related to the radio emission. Author (GRA)

N74-12338 Joint Publications Research Service, Arlington, Va.
STATISTICAL CHARACTERISTICS OF THE OUTGOING RADIATION FIELD
L. A. Pakhomov, L. A. Pakhomova, and N. G. Markin *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 21-28 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 19-25 (For availability see N74-12335 03-20)

N74-12341 Joint Publications Research Service, Arlington, Va.
SOME RESULTS OF OBSERVING ATMOSPHERIC OZONE IN CAIRO IN 1967-1969
Z. Metvalli *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 47-53 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 41-45 (For availability see N74-12335 03-20)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N74-12185 Deep Submergence Systems Project Office, Chevy Chase, Md.
AN IMPROVED DIRECT-READING METER FOR THE WBGT INDEX
L. E. MacHattie and L. A. Kuehn Jun. 1973 21 p refs
(DCIEM-73-R-947) Copyright. Avail: Issuing Activity

A portable instrument is described for monitoring the environmental factors contributing to human heat stress. Using silicon diode sensors, it continuously computes and displays on an electric meter the Wet Bulb Globe Temperature Index, defined as 0.7 times the natural wet bulb temperature plus 0.2 times the 6-inch black globe temperature plus 0.1 times the dry bulb temperature. A new arrangement has eliminated the dry bulb sensor and reduced the globe diameter to 1.65 inches without compromising the overall accuracy unduly. The reduction of globe size not only improves ease of handling but also makes the globe response time more nearly comparable with that of the wet bulb. Discrete transistor circuitry has been largely replaced by operational amplifiers and more attention has been paid to the proper size of the wet bulb, to the stability of the regulator and to controlling heat conduction in the sensor diode leads. The taut-band meter has a -hand calibrated scale and is protected against overload. Battery life is of the order of 700 hours. Author

N74-12186*# Montevallo Univ., Ala.
DESIGN AND MATHEMATICAL ANALYSIS OF A THREE-MIRROR X-RAY TELESCOPE BASED ON ATM S-056 X-RAY TELESCOPE HARDWARE Final Report
J. William Foreman, Jr. and Joseph M. Cardone Jul. 1973 60 p refs
(Contract NAS8-27301)
(NASA-CR-124474) Avail: NTIS HC $5.00 CSCL 20F

The mathematical design of the aspheric third mirror for the three-mirror X-ray telescope (TMXRT) is presented, along with the imaging characteristics of the telescope obtained by a ray trace analysis. The present design effort has been directed entirely toward obtaining an aspheric third mirror which will be compatible with existing S-056 paraboloidal-hyperboloidal mirrors. This compatability will facilitate the construction of a prototype model of the TMXRT, since it will only be necessary to fabricate one new mirror in order to obtain a working model. Author

N74-12187*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT MONITOR FOR JET ENGINE DISK CRACKS AND THE USE OF CRITICAL LENGTH CRITERION OF FRACTURE MECHANICS
John P. Barranger Washington Nov. 1973 21 p refs
(NASA-TN-D-7483; E-7570) Avail: NTIS HC $2.75 CSCL 21E

A disk crack detector is discussed which is intended to operate under flight conditions. It monitors the disk rim for surface cracks emanating from the blade root interface. An eddy current type sensor, with a remotely located capacitance/conductance bridge and signal analyzer, can reliably detect a simulated crack 3 mm long. The sensor was tested on a spinning turbine disk at 540 C. Tests indicate that the system is useful at disk rim velocities to 460 m/sec. By using fracture mechanics, it is shown for Inconel 718 th at a crack operating under a rim stress of 34 x ten to the 7th power N/sqm has a critical length of 18 mm. Author

N74-12188*# East Tennessee State Univ., Johnson City.
POTENTIAL OF LAND USE MAPPING IN THE TVA WITH HYPER-ALTITUDE AND SPACE PHOTOGRAPHY
William O. Lockman and Floyd M. Henderson May 1972 41 p refs Sponsored by NASA
(NASA-CR-136195; USGS-IR-NASA-245) Avail: NTIS HC $4.25 CSCL 08B

Color and color infrared photography obtained at three different scales over northern Alabama in November 1971 and supplemented by earlier photography from May 1971 are analyzed to evaluate the potential of hyper-altitude and space photography to satisfy the Tennessee Valley Authority's information needs regarding land use. Based primarily on imagery of seven test sites selected because of their topography, land use, and vegetation, analyses are made to determine the amount of detailed data obtainable at each scale and at two different times of year, and its possible application in monitoring land use. In most cases a 40 acre cell is the basis for land use evaluation. Author

N74-12189# Imperial Coll. of Science and Technology, London (England). Mechanical Engineering Dept.
THE INFLUENCE OF VELOCITY GRADIENT BROADENING ON MEAN AND rms VELOCITIES MEASURED BY LASER ANEMOMETRY
A. Melling Mar. 1973 25 p refs
(HTS/73/33) Avail: NTIS HC $3.25 CSCL 14B

A procedure for correcting mean velocities measured by laser anemometry in a flow with a spatially non-uniform velocity field is studied and applications for corrections to measured rms levels are recommended. Formulae for 'gradient broadening' corrections are derived for measured mean and rms velocity components for arbitrary velocity profiles. Their application suggests that the correction to mean velocity can be made negligible except when the measuring volume is not small relative to the flow dimensions; correction of the rms velocity components is more significant, and can be obtained by a piecewise linearization of the mean velocity profile. Author

N74-12190*# National Academy of Sciences - National Research Council, Washington, D.C.
ELECTRON MICROSCOPE APERTURE SYSTEM Patent Application
Klaus Heinemann, inventor (to NASA) Filed 28 Jun. 1973 17 p Sponsored by NASA
(NASA-Case-ARC-10448-2; US-Patent-Appl-SN-374424) Avail: NTIS HC $3.00 CSCL 20F

A method of making an electron microscope annular objective lens aperture is described. The method includes: (1) overlaying a specimen aperture base with a first layer of a copper grid and a second layer of a thin collodium film, (2) evaporating a thin conductive metallic layer onto the upper surface of the collodium film, (3) inserting the prepared aperture base into the objective slider of the electron microscope and imaging the condenser aperture onto the image plane and causing a decontamination layer to be deposited on the illuminated area of the metal layer, (4) electrolytically depositing a metal film onto the metallic layer, and (5) removing the contamination layer and underlying layers by ion etching from the side opposite the metallic film. NASA

N74-12191*# National Academy of Sciences - National Research Council, Washington, D.C.
ELECTRON MICROSCOPE APERTURE SYSTEM Patent Application
Klaus Heinemann, inventor (to NASA) Filed 23 Jul. 1973 17 p Sponsored by NASA
(NASA-Case-ARC-10448-3; US-Patent-Appl-SN-381848) Avail: NTIS HC $3.00 CSCL 20F

An electron microscope is described which includes an electron source, a condenser lens having either a circular aperture for focusing a solid cone of electrons onto a specimen or an annular aperture for focusing a hollow cone of electrons onto the specimen, and an objective lens having an annular objective aperture, for focusing electrons passing through the specimen onto an image plane. A method for making the annular objective aperture using electron imaging, electrolytic deposition and ion etching techniques is given. NASA

N74-12192# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
A NEW METHOD FOR THE RECORDING AND INDEPENDENT RECONSTRUCTION OF THE ISOPACHIC AND ISOCHROMATIC FRINGE PATTERNS WITH A SINGLE HOLOGRAM
A. Assa and A. A. Betser Jun. 1973 68 p refs
(TAE-181) Avail: NTIS HC $5.50

A method is described which will holographically record the isopachics and isochrematics on one and the same hologram. Moreover, these patterns are each independently recoverable; each appearing along with the virtual image of the model. A thorough theoretical treatment of the method is presented. This is done for two modes of application of the method; one using two reference waves and the other using a single reference wave. Relations are obtained which relate the intensity pattern of the virtual image to the stresses present in the model. Author

N74-12193*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYSIS OF THE FACSIMILE-CAMERA RESPONSE TO RADIANT POINT SOURCES
Friedrich O. Huck, Stephen J. Katzberg, Daniel J. Jobson, and Carl L. Fales, Jr. Washington Dec. 1973 44 p refs
(NASA-TN-D-7389; L-9048) Avail: NTIS HC $3.00 CSCL 14E

In addition to imaging the surrounding terrain, planetary lander cameras may also be used to survey the stars to aid in locating the lander site. The response of the facsimile camera, which was selected for the Viking lander missions to Mars, to a radiant point source is formulated and shown to result in a statistical rather than deterministic signal. The signal statistics are derived and magnitudes are evaluated for the brighter visual and red stars. The probability of detecting the resultant statistical signals in photosensor and preamplifier noise and the associated probability of false alarms are also determined. Author

N74-12194# National Oceanographic Instrumentation Center, Washington, D.C.
SERIES 8100 TEMPERATURE, SALINITY AND DEPTH SYSTEM, GUILDLINE INSTRUMENTS, INCORPORATED, LARCHMOUNT, NEW YORK 10538 Instrument Fact Sheet
Sep. 1973 11 p
(NOAA-IFS-74003) Avail: NTIS HC $3.00

The equipment which consists of a probe, and a control unit is described. It is designed to obtain continuous profiles of ocean temperature and conductivity (salinity) as a function of depth. Performance specifications, and calibration errors are presented. F.O.S.

N74-12195# Joint Publications Research Service, Arlington, Va.
CONTRAST METHOD OF PROCESSING PHOTOGRAPHS OF MARS
Yu. V. Batalov, M. M. Miroshnikov, and N. N. Porfiryeva 30 Nov. 1973 5 p refs Transl. into ENGLISH from Optikomekhanicheskaya Prom. (USSR), no. 9, 1973 p 11-12
(JPRS-60669) Avail: NTIS HC $3.00

The contrast procedure, used in processing six photographs of Mars obtained from a space vehicle, is discussed. It is shown that the use of the method provided additional details from relief features which were considered poorly distinguishable on the starting images. Author

N74-12196# Hanford Engineering Development Lab., Richland, Wash.
HIGH FREQUENCY INSTRUMENT FOR MATERIAL STRAIN MEASUREMENTS
T. R. Billeter 6 Apr. 1973 29 p refs Presented at 19th Ann. Meeting of the Am. Nucl. Soc., Chicago, Ill., 10 Jun. 1973
(Contract AT(45-1)-2170)
(HEDL-SA-528; Conf-730611-12) Avail: NTIS HC $3.50

A method and instrumentation operating at microwave frequencies for measuring uniaxail strain of a material are described. Achievement of the ultimate objective would permit continuous, accurate (to 0.00001-in.), and responsive (approximately milliseconds) strain measurements of specimens subjected to radiation environments at 1200 F. The employed cylindrical sensor (0.43-in. ID by 0.54-in. long), attached to the specimen, varies in length for specimen strains. As the sensor resonates at a microwave frequency dependent upon length, incident energy is absorbed at a frequency related to specimen strain. The sensor output signal, frequency of energy absorption, can be monitored with an accuracy of 1 in 10 to 7th power parts, thereby permitting determination of strains of 0 x 0.000001-in. Measurement accuracy approximately 2 x 0.00001-in. was achieved with apparatus operating in the 12.4 to 18.0 GHz frequency band. Results of tests with an experimental unit operating at approximately 36,000 MHz and 1000 F in a 92% argon-8% hydrogen gas environment indicated no degradation of operating characteristics after 2000 hours of use.
Author (NSA)

N74-12197# Commissariat a l'Energie Atomique, Saclay (France).
AUTOMATIC MEASUREMENTS
H. Roquefort 1973 91 p refs In FRENCH
(CEA-Conf-2212) Avail: AEC Depository Libraries HC $6.75

The term automatic measurements covers all measurements carried out automatically, generally by electronic methods. The operational procedure and data treatment are controlled by a memory, punched tapes, and small or large computers. Different systems are used according to their purpose: measurement bank, data acquisition, tests, and automatic measurements. The last term referes mainly to complex measurements requiring very precise metrology and relatively complicated calculations on the results. A choice must be made. The composition of a typical system and some information on the connections are given. The results are supplied on a teleprinter, curve plotter, or display system. These systems are of great value in many fields. Finally some practical examples of low- and high-voltage supplies, amplifiers, voltmeters, and analog-digital converters are given. Author (NSA)

N74-12198# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
MEASUREMENT OF RAINDROP SPECTRUM AND RAIN INTENSITY USING THE RAIN ANALYSER [ZUR MESSUNG DES TROPFENSPEKTRUMS IM REGEN UND DER REGENINTENSITAET MIT DEM REGENANALYSATOR]
Joerg Sander and Fred Schmidt 27 Sep. 1972 53 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft
(TB-157) Avail: NTIS HC $4.75

The equipment for measuring raindrop size distribution spectra is described together with the calibration method for determination of the relation between the output quantity of the rain analyzer and the drop size. Some results of the millimeter wave attenuation measurements, in which the equipment was employed, are presented. The latest version of this equipment is also described. ESRO

N74-12199# Royal Radar Establishment, Malvern (England).
THE UNITED KINGDOM STANDARD OF MICROWAVE POWER MEASUREMENT IN WAVEGUIDE 16 AND INTERNATIONAL INTERCOMPARISONS
I. A. Bagnall Oct. 1972 31 p refs
(RRE-TN-772; BR33193) Avail: NTIS HC $3.75

The development of United Kingdom standard of microwave power measurement at 8.2, 9.0, and 11.2 GHz in waveguide 16 is outlined. The calibration of the power standards for effective efficiency can be made with an uncertainty of plus or minus 0.2%. Intercomparisons were carried out at 9.0 GHz. The results of the trilateral intercomparison are given, and an estimation is made of the systematic and random errors. ESRO

N74-12200# Utah State Univ., Logan. Electro-Dynamics Lab.
A GAS LUBRICATED PLATFORM FOR INTERFEROMETRIC MEASUREMENTS
Ralph H. Haycock and Doran J. Baker May 1973 129 p refs Sponsored in part by DNA
(Contract F19628-72-C-0156)
(AD-766366; AFCRL-TR-73-0316; SR-1) Avail: NTIS CSCL 14/2

A gas lubricated slide was developed and used as the translating platform to constrain the motion of a movable wedge of a field-widened interferometer-spectrometer to within very precise limits. A unique mechanical configuration was required to facilitate the hand lapping operation required to obtain one wavelength flatness for all slide surfaces and parallelism within 25 micro inches. The low friction, absence of stick-slip friction and operation over temperature extremes of 70F to - 320F were the primary reasons for selecting gas as the lubricant. A graphical technique was developed to solve the gas flow equation for this configuration to maximize the load carrying capacity and stiffness. The effect of different types of compensation were graphically analyzed and the orifice selected. GRA

N74-12201# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SENSITIVITY OF VERY COARSE-GRAINED PHOTOEMULSIONS TO THE EFFECT OF X-RAYS
K. S. Bogomolov and S. A. Donskaya 27 Oct. 1972 9 p ref Transl. into ENGLISH from Zh. Nauch. i Priklad. Fot. i Kinematografii (Moscow), v. 16, no. 2, 1971 p 126-127
(AF Proj. 7351)
(AD-754592; FTD-HT-23-1019-72) Avail: NTIS CSCL 14/5

The notion exists that sensitivity to X-rays sharply depends on the dimensions of the emulsion crystals and the main way of increasing the sensitivity to X-rays can be the creation of very coarse-grained emulsions. This question is more complicated in practice. X-ray sensitometric indices for four series of emulsions, obtained by the ammonia-less and by the ammonia method were compared. Author (GRA)

N74-12202# Army Coastal Engineering Research Center, Washington, D.C.
AN ANNOTATED BIBLIOGRAPHY OF AERIAL REMOTE SENSING IN COASTAL ENGINEERING
Donald B. Stafford, Richard O. Bruno, and Harris M. Goldstein May 1973 133 p
(AD-766720; CERC-Misc-Paper-2-73) Avail: NTIS CSCL 08/6

A bibliography is presented of representative literature covering the applications of aerial remote sensing techniques to coastal engineering. About 200 references published since 1934 are presented. Annotations accompany each bibliographic entry and are a concise and informative summary of the references describing the characteristics of each remote sensor in coastal engineering investigations. Computer indexes of authors, titles and keywords are included. Author (GRA)

N74-12217 Radio Corp. of America, Moorestown, N.J.
LATEST METHODS OF FUNCTIONAL AND DIAGNOSTIC TESTING
F. Pfifferling and C. A. Schmidt *In* WESCON Improving Producibility 1973 12 p (For availability see N74-12203 03-15)
Copyright.

N74-12621 Hewlett-Packard Co., Palo Alto, Calif.
SYNERGISTIC TRENDS IN DIVERSE CAPABILITY INSTRUMENT DESIGN
James F. Horner *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12622 Systron Donner Corp., Culver City, Calif.
A NEW 'VALUE CONCEPT' IN TEST INSTRUMENTATION
Howard W. Mette *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

N74-12629 Tektronix, Inc., Beaverton, Oreg.
INTELLIGENCE IN ACQUISITION, PROCESSING, AND DISPLAY
Bruce Hamilton and Luis Navarro *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12630 TIME-DATA Corp., Palo Alto, Calif.
INTELLIGENCE IN INSTRUMENTATION
Leo J. Chamberlain *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 3 p (For availability see N74-12580 03-34)
Copyright.

N74-12634 Western Electronic Show and Convention, Los Angeles, Calif.
INTRUSION SENSORS
John H. Bryant (Omni Spectra, Inc.) *In its* The 1973 WESCON Tech. Papers, Vol. 17 1973 12 p ref (For availability see N74-12580 03-34)
Copyright.

N74-12641 Hewlett-Packard Co., Loveland, Colo.
SYSTEMS TYPE MEASUREMENTS IN THE LABORATORY USING PROGRAMMABLE BENCH INSTRUMENTS UNDER CALCULATOR CONTROL
Peter S. Stone *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12652 Lewis (Robert E.), Palo Alto, Calif.
MEASURING INSTRUMENTS: VISUAL EFFECTIVENESS OF LED'S AND LIQUID CRYSTALS
Robert E. Lewis *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

N74-12654 Fairchild Camera and Instrument Corp., Syosset, N.Y. Optoelectronics Div.
LEDS: A NEW MEASUREMENT STANDARD
Joseph S. Horwath *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p (For availability see N74-12580 03-34)
Copyright.

N74-12659 Fairchild Camera and Instrument Corp., Syosset, N.Y.
CAMERA ELECTRONICS: A NEW APPROACH
Donald E. Pezzolo *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p (For availability see N74-12580 03-34)
Copyright.

N74-12663 California State Polytechnic Univ., Pomona.
DIGITAL ALARM CLOCK WITH A LIGHT-RING DISPLAY
Taylor Gahr *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N74-12203 Western Electronic Show and Convention, Los Angeles, Calif.
IMPROVING PRODUCIBILITY
1973 161 p refs Presented at Manufacturing Workshop, San Francisco, 12-13 Sep. 1973; co-sponsored by WESCON and IEEE Manufacturing Technology Group
Copyright. Avail: Western Periodicals Co., 13000 Raymer Street, North Hollywood, Calif. 91605

The conference proceedings are presented and include papers on: (1) critical electronic components, (2) printed wiring board fabrication and testing, and (3) PWB techniques and testing aspects. For individual titles, see N74-12204 through N74-12217.

N74-12204 Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
ZENERS, DIODES AND TRANSISTORS **c09**
Roger L. Lohn *In* WESCON Improving Producibility 1973 29 p ref (For availability see N74-12203 03-15)
Copyright.

The screening is discussed of components in general, including the whys, hows, and to a certain extent the effectiveness. Construction information is contained along with recommended screens, standard manufacturing screening, and simple process flow charts for zeners, rectifiers and transistors. A failure rate prediction technique for these devices is included. Author

N74-12205 Allen-Bradley Co., Milwaukee, Wis.
CONSIDERATIONS FOR HIGH VOLUME HIGH QUALITY COMPONENTS MANUFACTURING
Robert Carlson *In* WESCON Improving Producibility 1973 9 p refs (For availability see N74-12203 03-15)
Copyright.

Some of the process controls required for the high volume producibility of fixed carbon composition resistors are discussed. Attention is focused on three specific areas which include: (1) component construction, (2) component producibility, and (3) examination of the component in terms of good process control and the resulting benifits to the components engineer. Author

N74-12206 Radio Corp. of America, Somerville, N.J. Solid State Div.
METHODS AND TEST PROCEDURES FOR ACHIEVING VARIOUS LEVELS OF POWER-TRANSISTOR RELIABILITY
D. M. Baugher and L. J. Gallace *In* WESCON Improving Producibility 1973 8 p refs (For availability see N74-12203 03-15)
Copyright.

Improved field failure rates for power semiconductor products are a primary user consideration in the mid 1970's. The trend indicates that a new level of awareness and sophistication has been reached in dealing with the problem of field failure. The paper describes, for power transistors, some reasons for the trend, methods and test procedures for achieving more reliable field performance, cost impact of screens, and hermetic versus plastic-package considerations. Author

N74-12207 Federal Pacific Electric Co., Sanford, N.C.
ALUMINUM ELECTROLYTIC CAPACITORS **c09**
John E. Hand and Edward L. Bowling *In* WESCON Improving Producibility 1973 12 p refs (For availability see N74-12203 03-15)
Copyright.

Aluminum electrolytic capacitors are analyzed with primary emphasis on the 'long life' types. These are referred to as Type 1 capacitors intended primarily for such applications as industrial, telecommunication, and avionics equipment where a high degree of stability of characteristics over a long life is essential. Two basic aluminum electrolytic capacitor styles are discussed; the axial lead and the cylindrical screw terminal. Each is available with different internal constructions and various header and seal designs. D.L.G.

N74-12208 Texas Instruments, Inc., Dallas.
INTEGRATED CIRCUIT QUALITY AND RELIABILITY CONSIDERATIONS **c10**
Jim D. Adams and D. Dwayne Ballew *In* WESCON Improving Producibility 1973 7 p refs (For availability see N74-12203 03-15)
Copyright.

Integrated circuit technology is assessed and the results are used as a basis for predicting future technological trends. The material presented includes the following: (1) general device description, (2) screening considerations, (3) quality oriented screens, (4) reliability oriented screens, (5) failure modes and mechanisms, and (6) standardization or registration trends. D.L.G.

N74-12209 Hewlett-Packard Co., Palo Alto, Calif.
OPTOELECTRONIC COMPONENTS: LEDS, DISPLAYS, COUPLERS **c10**
Hans O. Sorensen and Richard A. Fellows *In* WESCON Improving Producibility 1973 28 p refs (For availability see N74-12203 03-15)
Copyright.

An overview is presented of the manufacture of optoelectronic components, including methods of characterization and testing with emphasis on the optical port parameters. Reliability considerations and design recommendations are also given. Handling procedures, assembly techniques, and a few applications suggestions are included. Author

N74-12210 Xerox Printed Circuits, Pomona, Calif.
ALTERNATIVE PLATING TECHNOLOGIES USED IN THE FABRICATION OF PRINTED WIRING BOARDS
Edwin B. Flower *In* WESCON Improving producibility 1973 3 p (For availability see N74-12203 03-15)
Copyright.

The method of fabrication required to manufacture printed

wiring boards is briefly reviewed. A number of process flow charts are presented which provide some of the detail of the required processes without all the refinements that are necessary for each step. Author

N74-12211 Autonetics, Anaheim, Calif.
UNDERCUT: THE NEMESIS OF SUBTRACTIVE CIRCUIT BOARD PROCESSES **c10**
W. S. DeForest *In* WESCON Improving Producibility 1973 5 p refs (For availability see N74-12203 03-15)
Copyright.

Undercut, or line width reduction due to etching, is considered from the viewpoint that it poses a serious problem in subtractive types of processing. Some salient factors which affect the amount of undercut are examined in detail. These factors include: (1) etchant properties, (2) copper thickness, (3) etch resist, and (4) etchers. A table is included which lists the characteristics of various etchants. D.L.G.

N74-12212 Photocircuits Corp., Glen Cove, N.Y.
THE STATUS OF ADDITIVE TECHNOLOGY TODAY **c10**
George Messner *In* WESCON Improving Producibility 1973 7 p refs (For availability see N74-12203 03-15)
Copyright.

Additive technology is described as a method for manufacturing circuit boards starting from bare base laminates and producing the required electrical interconnecting patterns by selective deposition of metal. The semi-electroless CC-4 unclad, and the fully electroless CC-4 standard additive processes are compared. The basic steps of the additive processes are listed along with the advantages. Common misconceptions about additive technology are discussed. F.O.S.

N74-12213 Xerox Corp., El Segundo, Calif.
BARE PRINTED CIRCUIT BOARD TESTING **c10**
Rod Dixon *In* WESCON Improving Producibility 1973 3 p (For availability see N74-12203 03-15)
Copyright.

Recommended test procedures for circuit board manufacturers are presented. Topics discussed include: determination of test needs, types of testers available, choosing control and interface media, and tester installation. F.O.S.

N74-12214 Synergistic Products, Inc., Irvine, Calif.
AUTOMATED DIP INSERTION **c10**
Jeff Jones *In* WESCON Improving Producibility 1973 5 p (For availability see N74-12203 03-15)
Copyright.

This presentation deals with four aspects of automated DIP insertion. The first is the specification required for the DIPs themselves to insure reliable automated insertion; the second is the types of insertion machines available; the third is the criteria for determining hole size requirements; and fourth is machine justification. This information has been specifically prepared for the user to help him better understand what is required to prepare for automated DIP insertion. Author

N74-12215 Electrovert, Inc., Mt. Vernon, N.Y.
WAVESOLDERING TECHNIQUES AND THE ENVIRONMENT
H. E. Tawil *In* WESCON Improving Producibility 1973 7 p (For availability see N74-12203 03-15)
Copyright.

Controversial specifications for different processes for the wavesoldering of printed circuit boards (PCB) and component leads are discussed with special attention to the oil/no oil technology. Reliable soldering of component leads of PCB can be accomplished at high speeds and quality levels with properly prepared surfaces and appropriately mounted components. Wavesoldering, with or without oil, is discussed in the light of most advanced available equipment. Comparisons between drag and wavesoldering, importance of preheating of PCB, the use of horizontal and inclinable conveyors, postcleaning and the effects of the OSHA requirements on wavesoldering systems as a whole are discussed. Author

N74-12216 Hollis Engineering, Inc., Nashua, N.H.
THE USE OF OIL INTERMIX IN WAVE SOLDERING
Kenneth G. Boynton *In* WESCON Improving Producibility 1973 5 p refs (For availability see N74-12203 03-15)
Copyright.

The effects of oil and its use in wave soldering are discussed. Oil reduces the surface tension of the solder which spreads more readily on clean copper surfaces, and tends to offset deficiencies in surface affinity between solder and copper. The proper use is described of natural mineral oil, and vegetable oils. It is shown that advanced tinning oils coupled with the inclined converyor and wide solder wave are producing bridge- and icicle-free soldering of circuits with extremely narror line widths and spacings. F.O.S.

N74-12217 Radio Corp. of America, Moorestown, N.J.
LATEST METHODS OF FUNCTIONAL AND DIAGNOSTIC TESTING **c14**
F. Pfifferling and C. A. Schmidt *In* WESCON Improving Producibility 1973 12 p (For availability see N74-12203 03-15)
Copyright.

The state of the art of functional printed wiring board testing is reviewed. Realities of present day manual and automatic testing and fault detection are critically examined and strengths and weaknesses are discussed. Requirements for implementing automatic testing in the factory are defined in terms of capital investments, skill level of personnel and technology. A real life example of a manual vs automatic test approach is used to illustrate the discussion and provides the basis of a cost comparison. Test and defect data collection and sorting to highlight production tolerance trends and marginal design parameters are also discussed. Author

N74-12218*# SKF Industries, Inc., King of Prussia, Pa. Engineering and Research Center.
HIGH TEMPERATURE LUBRICANT SCREENING AND SYSTEMS STUDIES
David A. Jones Oct. 1973 216 p refs
(Contract NAS3-14320)
(NASA-CR-121188; SKF-AL73T024) Avail: NTIS HC $13.00 CSCL 11H

Four candidate lubricants for next generation aircraft gas turbine application were tested under open atmosphere conditions in a rig simulating an advanced engine 125 mm bore mainshaft thrust bearing position. Testing was conducted at speeds to 24,000 rpm (3,000,000 bearing DN), bearing ring temperature of 500 F, and with 1200 F air and 100 psi differential pressure across the seals installed in a dual tandem arrangement. Test bearing was a 125 mm bore split inner ring, outher race riding angular contact ball bearing under a 3280 lb. thrust load. One lubricant, a type 2 ester, performed extremely well. The mainshaft seal limited the performance. Numerous design improvements for this seal were indicated. Author

N74-12219*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERDISCIPLINARY APPROACH TO LIQUID LUBRICANT TECHNOLOGY
P. M. Ku, ed. (Southwest Res. Inst., San Antonio) Washington 1973 569 p refs Proc. of Sym. held at Cleveland, 11-13 Jan. 1972; sponsored by NASA
(NASA-SP-318; LC-72-600320) Avail: NTIS MF $1.45; SOD HC $4.35 CSCL 11H

The proceedings of a conference of liquid lubricant technology are presented. The subjects discussed are: (1) requirements and functions of liquid lubricants, (2) mineral oils, (3) greases, (4) theory of rheology, (5) mechanics and thermodynamics in lubrication, (6) environmental capability of liquid lubricants, and (7) wear corrosion and erosion. For individual titles, see N74-12220 through N74-12230.

N74-12220* University Coll. of Swansea (Wales). Tribology Centre.
LIQUID LUBRICANTS - FUNCTIONS AND REQUIREMENTS
A. R. Lansdown *In* NASA. Lewis Res. Center Interdisciplinary Approach to Liquid Lubricant Technol. 1973 p 1-55 refs (For availability see N74-12219 03-15)
CSCL 11H

The state of liquid lubricant technology is discussed. The

limit of present knowledge, especially in the boundary regime, is analyzed. Factors such as colloid behavior, viscoelastic effects, and relaxation times are investigated. Specific applications problems and some lubricant requirements which have not been met are reported. Author

N74-12221* Chevron Research Co., Richmond, Calif.
MINERAL OILS
N. W. Furby *In* NASA. Lewis Res. Center Interdisciplinary Approach to Liquid Lubricant Technol. 1973 p 57-100 refs (For availability see N74-12219 03-15)
CSCL 11H

The characteristics of lubricants made from mineral oils are discussed. Types and compositions of base stocks are reviewed and the product demands and compositions of typical products are outlined. Processes for commercial production of mineral oils are examined. Tables of data are included to show examples of product types and requirements. A chemical analysis of three types of mineral oils is reported. Author

N74-12222* Monsanto Co., St. Louis, Mo.
SYNTHETIC OILS
R. E. Hatton *In* NASA. Lewis Res. Center Interdisciplinary Approach to Liquid Lubricant Technol. 1973 p 101-135 refs (For availability see N74-12219 03-15)
CSCL 11H

Synthetic lubricants are discussed by chemical class and their general strengths and weaknesses in terms of lubrication properties are analyzed. Comparative ratings are given for 14 chemical classes and are used as a guide for lubricant selection. The effects of chemical structure on the properties of the lubricant are described with special emphasis on thermal stability. The diversity of synthetic lubricants which is provided by the wide range of properties permits many applications, some of which are reported. Author

N74-12223* Gulf Research and Development Co., Pittsburgh, Pa.
GREASES
P. R. McCarthy *In* NASA. Lewis Res. Center Interdisciplinary Approach to Liquid Lubricant Technol. 1973 p 137-185 refs (For availability see N74-12219 03-15)
CSCL 11H

The characteristics and applications of greases are discussed. The basic components of greases are analyzed to show the types of additives used and the basis for grease classification. Manufacturing methods for soap base and nonsoap base greases are described. The tests which are conducted to determine the properties of greases are reported. Author

N74-12224* Shell Research, Ltd., Chester (England).
THEORY OF RHEOLOGY
J. F. Hutton *In* NASA. Lewis Res. Center Interdisciplinary Approach to Liquid Lubricant Technol. 1973 p 187-261 refs (For availability see N74-12219 03-15)
CSCL 11H

The structure of the modern theory of rheology is discussed to show the assumptions and limitations. Rheology is discussed as a branch of continuum mechanics to determine the relationships between stress, strain, and strain rate which will give a closer representation of lubricant properties than the Newtonian flow equation. Rheology is also investigated as a branch of chemical physics. Consideration is limited to those theories of nonpolymeric and polymeric fluids which can represent viscoelasticity in terms of identifiable and measureable molecular characteristics. The possibility that elastic liquids may rupture in shear and linear tension analogous to the failure of solids is proposed. Author

N74-12225* Northwestern Univ., Evanston, Ill.
RHEOLOGY IN LUBRICATION
H. S. Cheng *In* NASA. Lewis Res. Center Interdisciplinary Approach to Liquid Lubricant Technol. 1973 p 263-314 refs (For availability see N74-12219 03-15)
CSCL 11H

The rheological effects on lubrication are discussed. The types of lubrication considered are thick film hydrodynamic lubrication and thin film elastohydrodynamic lubrication. The temperature-viscosity, viscoelastic, shear-thinning, and normal stess effects on the lubrication of journal bearings are analyzed. A graph of the pressure distribution of viscoelastic liquids in journal bearings is provided. Mathematical models are developed to define the effects of various properties of the lubricants on friction reduction. Author

N74-12226* Imperial Coll. of Science and Technology, London (England).
MECHANICS AND THERMODYNAMICS IN LUBRICATION
A. Cameron and C. R. Gentle *In* NASA. Lewis Res. Center Interdisciplinary Approach to Liquid Lubricant Technol. 1973 p 315-363 refs (For availability see N74-12219 03-15)
CSCL 11H

The causes for breakdown in the lubricant film of mineral oils are discussed. It is stated that the critical point is caused by desorption of the naturally occurring surface active agent and can be described by thermodynamic analysis. The effect of different metals in lubrication is surveyed. The problem of breakdown in elastohydrodynamic lubrication is treated phenomenologically by studying traction. The topics considered are classical and non-Newtonian explanations, anomalous film thickness and viscosity effects, surface roughess contributions, and solidification of the lubricant. Reasons for the apparent granular traction characteristics are examined. Author

N74-12227* Esso Research and Engineering Co., Linden, N.J.
ENVIRONMENTAL CAPABILITY OF LIQUID LUBRICANTS
A. Beerbower *In* NASA. Lewis Res. Center Interdisciplinary Approach to Liquid Lubricant Technol. 1973 p 365-431 refs (For availability see N74-12219 03-15)
CSCL 11H

The methods available for predicting the properties of liquid lubricants from their structural formulas are discussed. The methods make it possible to design lubricants by forecasting the results of changing the structure and to determine the limits to which liquid lubricants can cope with environmental extremes. The methods are arranged in order of their thermodynamic properties through empirical physical properties to chemical properties. Author

N74-12228* Lubrizol Corp., Cleveland, Ohio.
ADDITIVES
C. V. Smalheer *In* NASA. Lewis Res. Center Interdisciplinary Approach to Liquid Lubricant Technol. 1973 p 433-475 refs (For availability see N74-12219 03-15)
CSCL 11H

The chemistry of lubricant additives is discussed to show what the additives are chemically and what functions they perform in the lubrication of various kinds of equipment. Current theories regarding the mode of action of lubricant additives are presented. The additive groups discussed include the following: (1) detergents and dispersants, (2) corrosion inhibitors, (3) antioxidants, (4) viscosity index improvers, (5) pour point depressants, and (6) antifouling agents. Author

N74-12229* British Petroleum Co., Ltd., Sunbury-on-Thames (England). BP Research Center.
ROLE OF ADSORPTION IN LIQUID LUBRICATION
A. J. Groszek *In* NASA. Lewis Res. Center Interdisciplinary Approach to Liquid Lubricant Technol. 1973 p 477-525 refs (For availability see N74-12219 03-15)
CSCL 11H

Changes at solid-liquid interfaces caused by adsorption from solution are discussed paying attention to the following aspects: (1) stability of adsorbed films and the structure of metal-additive-film-liquid interface and effect of adsorbate orientation. (2) chemical versus physical adsorption, (3) heat of adsorption, (4) adsorption of additives, (5) activated adsorption, effect of activating adsorbates, (6) displacement phenomena at solid-liquid interfaces, (7) competition of antiwear additives, their solvents, and water, (8) effect of adsorption on the orientation of liquid in the interfacial region, and (9) relation between the chemical nature of solid surfaces and their interaction with liquid lubricants. The relevance of the above adsorption phenomena to lubrication is discussed, referring where possible to specific examples. Author

N74-12230* Mobil Research and Development Corp., Princeton, N.J. Central Research Div.

WEAR: CORROSION AND EROSION
C. N. Rowe *In* NASA. Lewis Res. Center Interdisciplinary Approach to Liquid Lubricant Technol. 1973 p 527-568 refs (For availability see N74-12219 03-15)
CSCL 11H

The various forms of corrosion are discussed and the role of localized electrochemical reactions in the wear of sliding surfaces are considered. It is stated that there is evidence that fretting corrosion, stress corrosion cracking, corrosion fatigue, and erosion corrosion have as a common basis the localized electrochemical reactions caused by a combination of the induced homogeneity of the surfaces and the corrosive environment. Several processes leading to erosive wear are discussed. Author

N74-12231*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IN-FLIGHT AND LABORATORY VACUUM-FRICTION TEST RESULTS
E. J. Devine, H. E. Evans, and W. A. Leasure Washington Dec. 1973 31 p refs
(NASA-TN-D-7419; G-7339) Avail: NTIS HC $3.00 CSCL 11H

Coefficient of friction measurements were made for six unlubricated metal couples exposed to the space environment aboard the OV-1-13 spacecraft and exposed to laboratory vacuum. Materials studied included mutually soluble, partially soluble, and incoluble metal combinations. Two samples of each material couple were tested in space and in the laboratory using the disk and rider technique. Linear velocity was 0.10 cm/s (2.5 in/min) and rider normal load was 4.45 N (1 lb) for the gold versus silver couples and 8.90 N (2lb) for the other combinations. Results showed that friction data obtained in a clean ion-pumped laboratory vacuum of 10 to the minus 10 power materials with low mutual solubility can be correlated to operation in the vicinity of a typical scientific spacecraft that is exposed to an ambient pressure as low as 10 to the minus 12 power torr. The expected increase in coefficient of friction with solubility was shown. Material couples with high mutual solubility present the hazard of unpredictable drastic friction increase in orbit which may not be evident in laboratory testing at levels down to 10 to the minus 10 power torr. It was also shown that gross cold welding of unlubricated metals exposed to a satellite environment does not occur. Author

N74-12232*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF STRESSES AT THE BORE OF A DRILLED BALL OPERATING IN A HIGH-SPEED BEARING
Harold H. Coe and John E. Lynch Washington Dec. 1973 20 p refs
(NASA-TN-D-7501; E-7405) Avail: NTIS HC $2.75 CSCL 13I

Three-dimensional stress distributions were calculated for both a regular drilled ball with a stiffening web. The balls were 20.6 mm (0.8125 in.) in diameter and had a 12.6 mm (0.496 in.) diameter concentric hole. The stiffening web was 1.5 mm (0.06 in.) thick. The calculations showed that a large reversing tangential stress at the hole bore was reduced by one-half by the addition of the web. Author

N74-12233*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELASTOHYDRODYNAMIC FILM THICKNESS FORMULA BASED ON X-RAY MEASUREMENTS WITH A SYNTHETIC PARAFFINIC OIL
Stuart H. Loewenthal, Richard J. Parker, and Erwin V. Zaretsky Washington Dec. 1973 23 p refs Prepared jointly by Army Air Mobility Res. and Develop. Lab.
(NASA-TN-D-7502; E-7041) Avail: NTIS HC $2.75 CSCL 11H

An empirical elastohydrodynamic film thickness formula for heavily loaded contacts based upon X-ray film thickness measurements made with a synthetic paraffinic oil is presented. The deduced relation was found to adequately reflect the high load dependence exhibited by the measured minimum film thickness data at high Hertizian contact stresses, that is, above 1.04 x 10 to the ninth N/sq m (150,000 psi). Comparisons were made with the numerical results from a theoretical isothermal film thickness formula. The effects of changes in contact geometry, material, and lubricant properties on the form of the empirical model are also discussed. Author

N74-12234*# Techtran Corp., Glen Burnie, Md.
ELASTIC VIBRATIONS IN ROLLER BEARINGS. 1: THE ROTATING MASS IS BALANCED WITH RESPECT TO ITS OWN ROTATIONAL AXIS
B. Szoke Washington NASA Nov. 1973 70 p refs Transl. into ENGLISH from Acta Tech. Acad. Sci. Hung. (Hungary), v. 72, nos. 1-2, 1972 p 3-72
(Contract NASw-2485)
(NASA-TT-F-15114) Avail: NTIS HC $5.50 CSCL 13I

The nature of the movements which can be made in various operational states from the midpoint of the rotating shaft in the bearing plane within limits determined by the bearing race on the one hand and by the load-induced deformations on the other are discussed. Evidence is obtained that in the case of a rotating mass balanced with respect to its own axis the point of application of the effective force is located at a single midpoint. The calculations for a bearing with clearance in the case when a loaded ball is in an unstable state are extended to the case of loaded balls in a stable state. It is thus shown that the so-called point load does not exist in even the simplest load arrangement. On the contrary the outer race, up to a certain speed, is acted upon at a spot determined by the phase angle (which depends on the instantaneous speed) by a hammering force the frequency of which is higher than the r.p.m. of the shaft. Author

N74-12235# National Bureau of Standards, Washington, D.C. Office of Weights and Measures.
EXAMINATION PROCEDURE OUTLINES FOR COMMERCIAL WEIGHING AND MEASURING DEVICES: A MANUAL FOR WEIGHTS AND MEASURES OFFICIALS
Otto K. Warnlof Jun. 1973 89 p
(NBS-Handbook-112) Avail: SOD $1.10 as C13.11:112

An operational guide for the field examination of commercial weighing and measuring devices is presented. The guide includes inspection and test procedures for various types of devices. Author

N74-12236# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
METHODS OF MEASUREMENT FOR SEMICONDUCTOR MATERIALS, PROCESS CONTROL, AND DEVICES Quarterly Report, 1 Apr. - 30 Jun. 1973
W. Murray Bullis, ed Nov. 1973 77 p refs Sponsored in part by Defense Nucl. Agency, ARPA, Navy Strategic Systems Proj. Office, AFWL and AEC
(NBS-TN-806) Avail: SOD HC $1.00 as C13.46:806

The development of methods of measurement for semiconductor materials, process control, and devices is reported. Significant accomplishments include: (1) Completion of an initial identification of the more important problems in process control for integrated circuit fabrication and assembly; (2) preparations for making silicon bulk resistivity wafer standards available to the industry; and (3) establishment of the relationship between carrier mobility and impurity density in silicon. Work is continuing on measurement of resistivity of semiconductor crystals; characterization of generation-recombination-trapping centers, including gold, in silicon; evaluation of wire bonds and die attachment; study of scanning electron microscopy for wafer inspection and test; measurement of thermal properties of semiconductor devices; determination of S-parameters and delay time in junction devices; and characterization of noise and conversion loss of microwave detector diodes. Author

N74-12237*# Marquardt Corp., Van Nuys, Calif.
ADVANCED TECHNOLOGY FOR SPACE SHUTTLE AUXILIARY PROPELLANT VALVES
H. Wichmann 23 May 1973 317 p refs
(Contract NAS3-14349)
(NASA-CR-120975; S-1261) Avail: NTIS HC $18.00 CSCL 13I

Valves for the gaseous hydrogen/gaseous oxygen shuttle auxiliary propulsion system are required to feature low leakage over a wide temperature range coupled with high cycle life.

long term compatibility and minimum maintenance. In addition, those valves used as thruster shutoff valves must feature fast response characteristics to achieve small, repeatable minimum impulse bits. These valve technology problems are solved by developing unique valve components such as sealing closures, guidance devices, and actuation means and by demonstrating two prototype valve concepts. One of the prototype valves is cycled over one million cycles without exceeding a leakage rate of 27 scc's per hour at 450 psia helium inlet pressure throughout the cycling program. Author

N74-12238# British Steel Corp., London (England). Metallurgy Dept.
SPECIFICATION AND APPLICATIONS OF CONTROLLED PROCESSED STEELS
R. F. Dewsnap, I. L. Dillamore, and D. Dulieu Jun. 1973 12 p refs Presented at ASM Congr., Cleveland, 18-19 Oct. 1972
(PB-222704/9; MG/49/72) Avail: NTIS HC $3.00 CSCL 13H

Control of the thermal and strain cycle in processing to hot mill products allows a considerable range of properties to be attained in low alloy steels. The paper examines the scope for the application of controlled processed steels in the light of their intrinsic capabilities and of the limitations of existing user specifications and design codes. Applications are found mainly in flat-roller products, where the process route and chemistry chosen will be appropriate to the required product thickness, but there is also scope for controlled processing to rods and bars. GRA

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N74-12239 Georgia Inst. of Tech., Atlanta.
ESTIMATION OF THE FREQUENCY OF LASER VELOCIMETER SIGNALS Ph.D. Thesis
John Burton Allen 1973 261 p
Avail: Univ. Microfilms Order No. 73-14088

The objective is to derive a mathematical model for laser velocimeter signals and to find a means to estimate the frequency of the signals. Expressions for the signals from the two types of velocimeters, namely the laser Doppler velocimeter and the laser interference velocimeter, are derived through the use of the Fresnel-Kirchhoff integral. The sources of noise in both systems are identified and their contributions to the total noise are assessed. Velocimeter systems were built and experiments were carried out to verify the signal and noise models. It is shown that under most conditions, velocimeter signals are discrete sinusoidal pulses with Gaussian envelopes and that the noise is white and Guassian. An estimator, called the Fourier transform estimator, is motivated and statistically analyzed. The estimator is found to perform well when the velocimeter signals are changing rapidly in frequency and when noise levels are high. Experiments were carried out which demonstrated the estimator's performance. Dissert. Abstr.

N74-12240 Maryland Univ., College Park.
EFFICIENT OPTICALLY COUPLED GaAlAs DIODE PUMPED Nd/YAG LASER Ph.D. Thesis
Ying Chao Kiang 1972 106 p
Avail: Univ. Microfilms Order No. 73-18249

An index matching method to increase the coupling efficiency of a GaAlAs diode pumped Nd/YAG laser is described. A solid glass half cylinder of 5.0 cm. diameter by 5.6 cm. long was used for index matching and also as a pumping cavity reflector. Twenty 0.015 inch x 0.100 inch GaALas diodes, connected in series, were aligned such that the emission area formed a straight line. Experiments performed with both the glass cylinder and a gold coated stainless steel reflector under the same operating conditions indicated that the index matching cylinder gave 159% to 199.5% improvement of coupling efficiency over the metal reflector at various operating temperatures. The dynamic and static behavior of the Nd/YAG laser has been analyzed using the nonlinear rate equations. The laser threshold, optimum power output and amplitude modulation by pumping intensity variation have been evaluated. Dissert. Abstr.

N74-12241 California Univ., Los Angeles.
SATURABLE MOLECULAR GASES AS LASER DEVICES: EFFECT OF DIFFUSION ON ABSORPTION AND SATURATION Ph.D. Thesis
Okan Kadri Ersoy 1972 205 p
Avail: Univ. Microfilms Order No. 73-6384

Saturable molecular gases are studied in their relation to lasers. First, sulfur hexafluoride and Freon 14 are used in a gas cell located inside a rotating mirror Q-switched CO2 laser to obtain high peak powers, short pulse lengths and to eliminate multiple pulses. Experimental results are justified by theoretical calculations. Two-level model, multi-level model and possible effects of diffusion are considered. Making use of linear approximations, a simple Q-switching theory is derived to gain more physical insight into the rotating mirror, passive, and simultaneous active and passive Q-switching techniques. Both experimental and theoretical studies show that it is possible to increase the peak power up to a factor of 4, to decrease the pulse length up to a factor of 10, and to get rid of multiple pulses by combining rotating mirror and passive Q-switching techniques. Dissert. Abstr.

N74-12242# Defence Research Establishment Valcartier (Quebec).
HYBRID COMPUTER SIMULATION OF A LADAR TARGET IMAGING SYSTEM
J. F. Boulter Sep. 1973 37 p refs
(Proj. 97-82-10)
(DREV-TN-2093/73) Avail: NTIS HC $4.00

A geometrical optics model describing the reflection of a pulsed laser from a target was derived and simulated on a hybrid computer. Approximate analytic expressions for the ladar cross section of simple targets were obtained. Simulation results for reflection from spherical and cylindrical targets were obtained and compared with experimental measurements made using an operational ladar system. A 24 by 32 element scan over simple targets was simulated and the results displayed either as a grayscale encoded image or as an isometric plot. Author

N74-12243*# Computer Sciences Corp., Falls Church, Va.
LASER TECHNOLOGY: A SURVEY Technology Utilization
Paul Zilczer Washington NASA 1973 54 p refs Sponsored by NASA
(NASA-SP-5116) Avail: NTIS MF $1.45; SOD HC $0.50 CSCL 20E

A survey was made of laser development, operating principles, and scientific advances made in laser technology. Data cover laser uses and suggestions for potential application of lasers. E.H.W.

N74-12244*# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
OPTICAL AND INFRARED MASERS Semiannual Status Reports, 1 Apr. 1971 - 30 Sep. 1972
13 Jul. 1973 66 p refs
(Grant NGL-22-009-012; MIT Proj. DSR-76148)
(NASA-CR-132876; SASR-17; SASR-18; SASR-19) Avail: NTIS HC $5.50 CSCL 20E

Ongoing research progress in the following areas is described: (1) tunable infrared light sources and applications; (2) precision frequency and wavelength measurements in the infrared with applications to atomic clocks; (3) zero-degree pulse propagation in resonant medium; (4) observation of Dicke superradiance in optically pumped HF gas; (5) unidirectional laser amplifier with built-in isolator; and (6) progress in infrared metal-to-metal point contact tunneling diodes. A.L.

N74-12245# Sandia Labs., Albuquerque, N.Mex.
LASER FUSION
R. E. Palmer [1973] 7 p Sponsored by AEC
(SLA-73-5352) Avail: NTIS HC $3.00

The application of lasers for sustaining controlled fusion is discussed. The basic conditions necessary to achieve fusion are described along with two other possible techniques, namely, electromagnetic confinement and electron beam heating. The

principal problems facing fusion research and the future of laser fusion are described. NSA

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N74-12246 Illinois Univ., Chicago.
THE THERMODYNAMIC BEHAVIOR OF SULFUR IN MOLTEN NICKEL-BASE ALLOYS Ph.D. Thesis
Wilfredo V. Venal 1973 123 p
Avail: Univ. Microfilms Order No. 73-15012

The thermodynamic properties of dilute solutions of sulfur in pure liquid nickel were investigated at 1500, 1550 and 1575 C for sulfur concentrations up to 0.7 wt %. Three composition variables, namely wt %S, Xs and Zs were used to analyze the data. Measured values of the activity coefficient of sulfur in the quaternary system Ni-S-Cr-Fe agreed reasonably well with those predicted from binary and ternary data. Slag-metal sulfur distribution experiments confirmed qualitatively the effect of the alloying elements studied on the activity coefficient of sulur as evidenced by the measured values of the sulfur distribution ratio. Comparison of experimental data with solution models suggest random mixing behavior of sulfur in the ternary system Ni-S-Fe. Dissert. Abstr.

N74-12247 British Library Lending Div., Boston Spa (England).
THE INFLUENCE OF ELECTROLYTICALLY POLISHED COPPER SUBSTRATE ON THE STRUCTURE OF ELECTRO-DEPOSITED NICKEL
A. Dziuve, F. Aleinikovas, and J. Matulis 3 Sep. 1973 8 p refs Transl. into ENGLISH from Liet. TSR Mokslu Akad. Darb., Ser. B (Vilnyus), v. 1, no. 60, 1970 p 27-32
(BLL-OA-Trans-1291-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The extent of the influence of the structure of electrolytically polished copper substrates on the structure of electrolytic nickel, deposited in very thick layers was studied. Author

N74-12248# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.
FATIGUE CRACK GROWTH AND RESIDUAL STRENGTH OF ALUMINIUM ALLOY SHEET AT TEMPERATURES DOWN TO -75C
D. Broek Jun. 1972 51 p refs Sponsored by Neth. Agency for Aerospace Programs
(NLR-TR-72096-U) Avail: NTIS HC $4.75

Two aluminum alloy sheet materials used in aircraft structures were tested for the effect of temperature on the rate of fatigue, crack propagation, and residual strength. The materials tested were 2024-T3 and 7075-T6 clad sheets of 2 mm thickness and 7075-T6 clad sheets of 4 mm thickness. Testing temperatures varied from room temperature to -75 C. It was found that fatigue crack propagation was slower at low temperatures as a result of the low moisture content of cold air. The plane stress fracture touchness of 7075-T6 at -50 C was only 70% of the value at room temperature. Temperatures in the high layers of the stratosphere and troposphere have a beneficial effect on fatigue crack growth. ESRO

N74-12249*# Case Inst. of Tech., Cleveland, Ohio. School of Engineering.
DEFORMATION AND ANNEALING RESPONSE OF TD-NICKEL CHROMIUM SHEET Annual Status Report, Jul. 1973
R. D. Kane and L. J. Ebert Jul. 1973 50 p refs
(Grant NGR-36-003-094)
Avail: NTIS HC $4.50 CSCL 11F

The deformation and annealing response of TD-nickel chromium (TD-NiCr) 0.1 inch thick sheet was examined using various cold-rolling and annealing treatments. Upon annealing (above 816 C (1500 F), the as-received material was converted from an initially ultra-fine grain size (average grain dimension 0.51 micron) to a large grain structure. Increases in grain size by a factor of 100 to 200 were observed for this transformation. However, in those material states where the large grain transformation was absent, a fine grain recrystallized structure formed upon annealing (above 732 C (1350 F)). The deformation and annealing response of TD-NiCr sheet was evaluated with respect to the processing related variables as mode and severity of deformation and annealing temperature. Results indicate that the large grain transformation, classical primary recrystallization occurs. Using selected materials produced during the deformation and annealing study, the elevated temperature tensile properties of TD-NiCr sheet were examined in the temperature range 593 C (1100 F) to 1093 C (2000 F). It was observed that the elevated temperature tensile properties of TD-NiCr sheet could be optimized by the stabilization of a large grain size in this material using the cold working and/or annealing treatments developed during the present investigation. Author

N74-12250*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AUGER ELECTRON SPECTROSCOPY STUDY OF INITIAL STAGES OF OXIDATION IN A COPPER - 19.6-ATOMIC-PERCENT-ALUMINUM ALLOY
John Ferrante Washington Nov. 1973 21 p refs
(NASA-TN-D-7479; E-6935) Avail: NTIS HC $2.75 CSCL 11F

Auger electron spectroscopy was used to examine the initial stages of oxidation of a polycrystalline copper - 19.6 a/o-aluminum alloy. The growth of the 55-eV aluminum oxide peak and the decay of the 59-, 62-, and 937-eV copper peaks were examined as functions of temperature, exposure, and pressure. Pressures ranged from 1x10 to the minus 7th power to 0.0005 torr of O2. Temperatures ranged from room temperature to 700 C. A completely aluminum oxide surface layer was obtained in all cases. Complete disapperance of the underlying 937-eV copper peak was obtained by heating at 700 C in O2 at 0.0005 torr for 1 hr. Temperature studies indicated that thermally activated diffusion was important to the oxidation studies. The initial stages of oxidation followed a logarithmic growth curve. Author

N74-12251*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ISOTHERMAL AND CYCLIC OXIDATION AT 1000 AND 1100 DEG C OF FOUR NICKEL-BASE ALLOYS: NASA-TRW VIA, B-1900, 713C, AND 738X
Charles A. Barrett, Gilbert J. Santoro, and Carl E. Lowell Washington Nov. 1973 34 p refs
(NASA-TN-D-7484; E-7488) Avail: NTIS HC $3.00 CSCL 11F

The isothermal and cyclic oxidation resistance of four cast Ni-base gamma + gamma prime alloys, NASA-TRW Via, B-1900, 713C, and 738X, was determined in still air at 1000 and 1100 C. The oxidation process was evaluated by specific sample weight change with time, sample thickness change, X-ray diffraction of the scales, and sample metallography. The behavior is discussed in terms of the Cr, Al, and refractory metal contents of the alloys. Author

N74-12252 British Steel Corp., London (England). Strip Mills Div.
QUALITATIVE ANALYSIS OF STEELWORKS MATERIALS BY THIN LAYER CHROMATOGRAPHY
H. J. Boniface, R. O. OLeary, and R. H. Jenkins [1973] 9 p refs Original contains color illustration
(SM/556/A) Copyright. Avail: Issuing Activity

A published scheme for the identification of cations by thin layer chromatography was modified to produce a simpler operating procedure. Fifteen cations, Fe, Sn, Cd, Zn, Co, Cu, Mn, V, Pb, Cr, Al, Ca, Mg, Ti, and Ni may be detected in a variety of steelworks materials. The scheme is particularly useful in providing preliminary qualitative information, from which a suitable analytical technique may be chosen for quantitative analysis. Author

N74-12253# National Engineering Lab., East Kilbride (Scotland). Forming and Fabrication Div.

THE UTILIZATION OF MILD STEEL MACHINING SWARF IN HOT FORGING
R. J. Dower and D. R. Oakley Apr. 1973 19 p refs
(NEL-542) Avail: NTIS HC $3.00

Methods for improving material utilization in order to reduce the loss of revenue involved in producing low value swarf in machining operations. The reclamation of machining swarf by the hot extrusion of compacted billets is reported. The characteristics of the resulting material are analyzed. The microstructure of products made from processed swarf is illustrated to show the physical properties. Author

N74-12254*# Lehigh Univ., Bethlehem, Pa.
THE INFLUENCE OF TEMPERATURE ON FATIGUE-CRACK GROWTH IN A MILL-ANNEALED Ti-6Al-4V ALLOY
R. P. Wei and D. L. Ritter 29 Jun. 1971 41 p refs
(Grant NGR-39-007-040)
(NASA-CR-111958) Avail: NTIS HC $4.25 CSCL 11F

To understand the influence of temperature on the rate of fatigue crack growth in high strength metal alloys, constant load amplitude fatigue crack growth experiments were carried out using a 1/4 inch thick (6.35 mm) mill-annealed Ti-6Al-4V alloy plate as a model material. The rates of fatigue crack growth were determined as a function of temperature, ranging from room temperature to about 290 C and as a function of the crack tip, stress intensity factor K, in dehumidified high purity argon environment. The dependence of the rate of fatigue crack growth on K appears to be separable into two regions. The transition correlates with changes in both the microscopic and macroscopic appearances of the fracture surfaces, and suggests a change in the mechanism and the influence of microstructure on fatigue crack growth. Author

N74-12255*# Kanner (Leo) Associates, Redwood City, Calif.
PROCESS FOR SURFACE-TREATING METALS BY THE APPLICATION OF SILICATE FILMS
Alois Seidl and Friedrich Leonhard Washington NASA Dec. 1973 8 p Transl. into ENGLISH from German printed patent application 1,019,140, 7 Nov. 1957, supplement to patent application D 17348 IVc/48c (printed patent application 1,015,298) 3 p
(Contract NASw-2481)
(NASA-TT-F-15217) Avail: NTIS HC $3.00 CSCL 11F

A published disclosure is given of a supplementary patent application for a method of protecting metal surfaces, e.g. silverware, by applying a film containing an SiO_2:Na_2O ratio greater than 3.3:1, preferably between 3.9:1 and 5.5:1. The claims cover: air and heat drying; the bonding of the alkali oxide to added anions (e.g. phosphate or chromate); production of alkali silicate solutions by treating water glass solutions with finely divided silicic acid at elevated temperature and pressure; production of alkali silicate solutions by treating solid water glass with aqueous dispersions of finely divided silicic acid; addition of substances imparting coloration or hydrophobic properties to the solutions; and aftertreatment of the silicate films with silicones and the like. Author

N74-12256*# Kanner (Leo) Associates, Redwood City, Calif.
FINISH CONTAINING ZINC DUST FOR PROTECTION AGAINST CORROSION
Helmut vonFreyhold Washington NASA Dec. 1973 5 p Transl. into ENGLISH from German patent no. 1,205,218, 28 Jul. 1966 2 p
(Contract NASw-2481)
(NASA-TT-F-15218) Avail: NTIS HC $3.00 CSCL 11F

A patent has been issued for finishes based on alkali silicate solutions to which alkali chromates and organic diamines are added, particularly hexamethylenetetramine, to increase stability from a few days to 1 or 2 weeks. Claims also cover the addition of emulsifiers and/or acetic acid esters. The use of various thickeners and extenders is likewise discussed. Author

N74-12257# Kanner (Leo) Associates, Redwood City, Calif.
EFFECTS OF AIR POLLUTION ON METALS
Yoshinori Tajiri May 1973 30 p refs Transl. into ENGLISH from Clean Air (Japan), v. 10, no. 5, Oct. 1972 p 90-99 Sponsored by Environ. Protect. Agency
(KS-30; APTIC-47606) Avail: NTIS

The relationship is described between corrosion of metals and air pollution in terms of service life of metals with the meteorological aspects taken into account. Factory exhausts such as SO2 and H2S are examined with their interactions on such metals as copper, copper alloys, iron, and steel. Modes of corrosion by clean air, classification of air pollution, atmospheric exposure tests, the influence of sulfurous gas, dust, and sea salt are reported along with a bibliography. T.M.R.

N74-12258# Kanner (Leo) Associates, Redwood City, Calif.
METHODS AND ACTUAL TECHNIQUES OF MEASURING HEAVY METALS IN THE ENVIRONMENTAL ATMOSPHERE
Manabu Tani Jan. 1973 19 p refs Transl. into ENGLISH from Kogai To Taisaku (Tokyo), v. 8, no. 6, Jun. 1972 p 551-555 Sponsored by Environ. Protection Agency
(TR-292-73; APTIC-42360) Avail: NTIS HC $3.00

The methods and techniques used in emission spectrography and atomic absorption for measuring heavy metals in air are described. The collection of samples, sample processing, equipment, and materials are discussed. F.O.S.

N74-12259*# IIT Research Inst., Chicago, Ill. Metals Research Div.
ADDITIONAL THERMAL FATIGUE DATA ON NICKEL AND COBALT-BASE SUPERALLOYS Final Report, 11 Jun. 1970 - 28 Feb. 1973
Maurice A. H. Howes 15 Mar. 1973 75 p refs
(Contract NAS3-14311)
(NASA-CR-121212; IITRI-B6107-34-Pt-2) Avail: NTIS HC $5.75 CSCL 11D

The fluidized bed technique was used to measure the relative thermal fatigue resistance of 21 superalloys: B1900, B1900 DID, IN-100, MAR-M 200, Udimet 700 wrought and cast, NX-188, WAZ-20, TAZ-8A, M22, IN 713C, IN 738, IN 162, MAR-M 509, Rene 80, RBH, NASA VI A, TD-NiCr, MAR-M 302, WI-52, and X-40. IN-100, MAR-M 200, NX-188, WAZ-20 and TAZ-8A were also tested in the directionally solidified form. B1900, B1900 DID, IN-100, MAR-M200, Udimet 700, NX-188, WAZ-20 and TAZ-8A were tested with surface protection. Among the 36 variations of composition, solidification method, and surface protection the cycles to cracking differed by 2 to 3 orders of magnitude. Some alloys suffered serious weight losses and oxidation. Previous fluidized bed thermal fatigue data on some of these alloys were reported in N71-10027. Thermal fatigue data, oxidation, and dimensional changes are reported in N73-30507. Metallographic and hardness data are given in this report. Author

N74-12260# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF MUTUAL DIFFUSION IN NICKEL-TUNGSTEN AND PALLADIUM-TUNGSTEN SYSTEMS
V. N. Pimenov and Yu. E. Ugaste 26 Nov. 1973 11 p refs Transl. into ENGLISH from Fiz. Metal. Metalloved. (USSR), v. 35, no. 3, 1973 p 1-6
(JPRS-60622) Avail: NTIS HC $3.00

The results of an investigation on mutual diffusion in nickel-tungsten and palladium-tungsten systems are given. Author

N74-12261*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FATIGUE-TEST ACCELERATION WITH FLIGHT-BY-FLIGHT LOADING AND HEATING TO SIMULATE SUPERSONIC-TRANSPORT OPERATION
L. A. Imig and L. E. Garrett Washington Dec. 1973 50 p refs
(NASA-TN-D-7380; L-8992) Avail: NTIS HC $3.00 CSCL 01C

Possibilities for reducing fatigue-test time for supersonic-transport materials and structures were studied in tests with simulated flight-by-flight loading. In order to determine whether short-time tests were feasible, the results of accelerated tests (2 sec per flight) were compared with the results of real-time tests (96 min per flight). The effects of design mean stress, the stress range for ground-air-ground cycles, simulated thermal stress, the number of stress cycles in each flight, and salt corrosion

were studied. The flight-by-flight stress sequences were applied to notched sheet specimens of Ti-8Al-1Mo-1V and Ti-6Al-4V titanium alloys. A linear cumulative-damage analysis accounted for large changes in stress range of the simulated flights but did not account for the differences between real-time and accelerated tests. The fatigue lives from accelerated tests were generally within a factor of two of the lives from real-time tests; thus, within the scope of the investigation, accelerated testing seems feasible. Author

N74-12262# Erlangen-Nuremberg Univ. (West Germany).
MANUFACTURE AND PROPERTIES OF TITANIUM AND TITANIUM ALLOYS EMPHASIZING THEIR USE IN AERONAUTICS. PART 4: CORROSION AND OXIDATION [HERSTELLUNG UND EIGENSCHAFTEN VON TITAN UND TITANLEGIERUNGEN UNTER BESONDERER BERUECKSICHTIGUNG DER LUFTFAHRT. TEIL 4: KORROSION UND OXIDATION]
May 1973 105 p refs In GERMAN Proc. of the 3rd Internal Colloq. of the Material Sci. Inst. II, Erlangen, West Ger., 11-12 Oct. 1972 4 Vol.
Avail: NTIS HC $7.25

Conference papers on stress corrosion cracking of Ti and Ti alloys are summarized. Data cover corrosion caused by methyl alcohol, aqueous solutions, and atmospheric moisture as well as hot salts. For individual titles, see N74-12263 through N74-12267.

N74-12263 Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Werkstoffwissenschaften IV.
STRESS CORROSION CRACKING OF TITANIUM MATERIALS. STATE-OF-THE-ART [DIE SPANNUNGSRISSKORROSION DER TITAN-WERKSTOFFE: STAND DER FORSCHUNG]
H. Kaesche *In its* Manuf. and Properties of Titanium and Titanium Alloys Emphasizing their Use in Aeron., pt. 4 May 1973 42 p refs In GERMAN (For availability see N74-12262 03-17)

Stress corrosion cracking (SCC) of titanium and titanium alloys was investigated. A survey of the electrochemistry of titanium corrosion is presented. The following subjects are highlighted: the SCC of titanium in alcohols with halogenide content; the SCC of titanium alloys in chloride containing methyl alcohol; the SCC of the alloys in aqueous halogenide solutions; the mechanism of SCC in aqueous solutions; the effects of hot salts on the SCC. ESRO

N74-12264 Krupp (Fried.) G.m.b.H., Essen (West Germany).
STRESS CORROSION CRACKING OF TITANIUM ALLOYS IN GASEOUS HYDROGEN CHLORIDE AND RELATION WITH HOT NaCl CORROSION [SPANNUNGSRISSKORROSION VON TITANLEGIERUNGEN IN GASFOERMIGEM CHLORWASSERSTOFF UND ZUSAMMENHANG MIT DER HEISSALZKORROSION]
Dieter Hirschfeld and Ulrich Bimler *In* Erlangen-Nuremberg Univ. Manuf. and Properties of Titanium and Titanium Alloys Emphasizing their Use in Aeron., pt. 4 May 1973 25 p refs In GERMAN (For availability see N74-12262 03-17)

Investigations, the object of which was to increase knowledge regarding the mechanism of stress corrosion cracking of titanium alloy specimens with salt layers at high temperatures, are reported. The results of tests with gaseous HCl show that a preferential attack of certain microstructure constituents, especially the grain boundaries, could not be ascertained. For notched specimens with salt layers it was observed that the cracks in the notch zone follow the elastic/plastic boundary surfaces, whereas the fatigue crack only grows a few tenths of a mm into the material, and then stops. For stress corrosion cracking two sequential phases in time are discussed: crack initiation and crack propagation. ESRO

N74-12265 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Werkstoff-Forschung.
REPASSIVATION BEHAVIOR OF TiAl6V4 IN SODIUM HALIDES [REPASSIVIERUNGSVERHALTEN VON TiAl6V4 IN NATRIUM-HALOGENIDEN]
H. Buhl *In* Erlangen-Nuremberg Univ. Manuf. and Properties of Titanium and Titanium Alloys Emphasizing their Use in Aeron., pt. 4 May 1973 13 p refs In GERMAN Sponsored by Bundesmin. fuer Verteidigung (For availability see N74-12262 03-17)

The repassivation behavior of TiAl6V4, activated by a mechanical planning process, was investigated. Time range was from 1 ms after activation to 20 ms. The measurements were carried out at zero volt against the 3.5 n-Ag/AcCl electrode in sodium halides of different concentrations. Results show that repassivation takes place according to a decomposition-separation mechanism. During the decomposition period the boundary surface remains active. The separation of an unknown reaction product ends the active state of the titanium boundary surface, and introduces the growth of the passive layer. ESRO

N74-12266 Metallgesellschaft, A.G., Frankfurt am Main (West Germany).
EFFECT OF ATMOSPHERIC MOISTURE CONTENT ON NaCl CORROSION OF TITANIUM ALLOYS BETWEEN 300 AND 500 C [EINFLUSS DES WASSERGEHALTES DER ATMOSPHAERE AUF DIE SALZKORROSION VON TITANLEGIERUNGEN ZWISCHEN 300 UND 500 C]
R. Weidemann *In* Erlangen-Nuremberg Univ. Manuf. and Properties of Titanium and Titanium Alloys Emphasizing their Use in Aeron., pt. 4 May 1973 14 p In GERMAN (For availability see N74-12262 03-17)

The effect of atmospheric moisture content upon the high temperature stress corrosion cracking of titanium alloys is surveyed. From literature, it is shown that for crack initiation a certain minimum water content is necessary. This is explained by the possible reaction equations. The critical moisture range lies approximately at room water content: 60% relative moisture at 20 C. The differences in results between laboratory tests and practice are pointed out. Although laboratory tests have determined high temperature stress corrosion cracking sensitivity, in practice no damage of this type is found. ESRO

N74-12267 Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
FORMATION OF SURFACE LAYERS ON TECHNICAL TITANIUM ALLOYS [BILDUNG VON OBERFLAECHENSCHICHTEN AUF TECHNISCHEN TITANLEGIERUNGEN]
Klaus Ruedinger and Hans Hermann Weigand (Contimet GmbH) *In* Erlangen-Nuremberg Univ. Manuf. and Properties of Titanium and Titanium Alloys Emphasizing their Use in Aeron., pt. 4 May 1973 11 p In GERMAN (For availability see N74-12262 03-17)

A series of Ti alloys with different microstructure were observed to study the development of surface layers during annealing in air. A comparison was made of the behavior of the alloys and the effects of microstructure on the alloying elements. The alloys studied include non-alloyed Ti, Ti-5Al-2, 5Sn, alpha plus beta alloys with and without Al, and the beta alloy Ti-13V-11Cr-3Al. ESRO

N74-12268# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
ANOMALOUS ELECTRICAL RESISTIVITIES AND MAGNETIC PROPERTIES OF AMORPHOUS METALLIC ALLOYS
R. Hasegawa Jun. 1973 74 p refs
(Contract AT(04-3)-822)
(CALT-822-52) Avail: NTIS HC $5.75

Results of electrical resistivity, magnetoresistivity and magnetization measurements are presented for the temperature range 1.3 to 300 K on amorphous Ni-Pd-P alloys in which Ni is replaced by Fe. In this pseudobinary system, magnetism of the alloys changes from Pauli like paramagnetism in Ni-Pd-P to well defined ferromagnetism in Fe-Pd-P. The dilute alloys containing less than 10 at. % Fe can be classified as amorphous Kondo alloys. It is shown that resistivity and magnetic anomalies can be explained by assuming the existance of single and pair iron impurity states, the former having a Kondo temperature of about 14 K and the latter less than 1 K. NSA

N74-12269# Minnesota Univ., Minneapolis. Inst. of Technology.
DIFFUSION STUDIES IN LIQUID METALS
M. Hsieh and R. A. Swalin Apr. 1973 50 p refs
(COO-841-28) Avail: NTIS HC $4.50

Self-diffusion measurements using tracers were carried out in liquid K and Rb at 1 atm, varying pressure up to 3450 bar, constant volume, and temperatures from 337 to 867 K. Equations were derived for self-diffusion coefficients, and activation volumes were estimated. NSA

N74-12270# Oak Ridge National Lab., Tenn.
RADIATION STRENGTHENING AND EMBRITTLEMENT IN HEAVY-SECTION STEEL PLATES AND WELDS
W. J. Stelzman and R. G. Berggren Jun. 1973 57 p refs
(Contract W-7405-eng-26)
(ORNL-4871) Avail: NTIS HC $5.45

Fast-neutron-induced changes in the mechanical properties of two 12-in.-thick A533-B, class 1 steel plates and a matching submerged-arc weldment and an electroslag weld in a 63/8-in.-thick SA302-B (code case 1339) steel are presented. Postirradiation increases of strength and notch-impact transition temperature and decrease in ductility were determined for several irradiation temperatures. Observations using data obtained from an instrumented Charpy testing machine are also given.
Author (NSA)

N74-12271# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
EFFECT OF CARBON AND NITROGEN ON THE SHORT-TERM TENSILE BEHAVIOR OF SOLUTION-TREATED TYPES 304 AND 316 STAINLESS STEELS
P. Soo and W. H. Horton Jul. 1973 48 p refs
(Contract AT(11-1)-3045)
(WARD-NA-3045-2) Avail: NTIS

An analysis has been conducted to determine the effects of interstitial carbon and nitrogen on the short-term tensile behavior of solution-treated Types 304 and 316 stainless steel. At constant test temperature, it is shown that the yield strength, ultimate tensile strength, and total elongation are proportional to the combined carbon and nitrogen concentration, for carbon and nitrogen levels below about 0.13 weight percent. Statistical design equations have been evaluated for these materials that give the tensile properties as a function of test temperature and total interstitial level. Author (NSA)

N74-12272# Cornell Univ., Ithaca, N.Y. Materials Science Center.
THEORY OF DIFFUSE X-RAY SCATTERING BY INTERSTITIALS IN BCC METALS
R. Benedek and P. S. Ho Jun. 1973 16 p refs
(Contract AT(11-1)-3158)
(COO-3158-22) Avail: NTIS HC $3.00

Starting with a Green's function lattice statics approach, an expression is derived for the diffuse X-ray scattering cross section of interstitials in cubic metals. Numerical calculations were performed, based on interatomic potentials for tungsten, for the six possible geometrical configurations of an intrinsic interstitial in a BCC metal. The relevance of such calculations to the problem of determining the stable form of the interstitial is discussed.
Author (NSA)

N74-12273# Los Alamos Scientific Lab., N.Mex.
BERYLLIUM, THE CRITERIA DOCUMENT
H. F. Schulte 1973 13 p Presented at AIHA Conf., Boston, Mass., 20 May 1973
(Contract W-7405-eng-36)
(LA-UR-73-678; Conf-730518-4) Avail: NTIS HC $3.00

Beryllium is an especially toxic substance used industrially. Standards for Be air concentrations, ventilation, personnel protection by the use of face masks, and waste disposal adopted by the USAEC in 1949 are reviewed and compared with standards proposed recently under the Occupational Safety and Health Act. Author

N74-12274# California Univ., Berkeley. Lawrence Berkeley Lab.
STRUCTURE, STRENGTH, AND TOUGHNESS OF Fe/Cr/C MARTENSITIC STEELS M.S. Thesis
J. A. McMahon Jan. 1973 63 p refs
(Contract W-7405-eng-48)
(LBL-1181) Avail: NTIS HC $5.25

The changes in microstructure and mechanical properties of Fe/Cr/C martensitic steels as functions of chromium and carbon content were investigated using transmission electron microscopy and tensile, compressive, and fracture toughness testing. The as-quenched martensitic microstructures and the carbide morphologies produced by tempering at 200, 400, and 600 C were analyzed. For a given carbon content, the volume fraction of martensite containing transformation twins increased with chromium concentration, demonstrating that chromium induces transformation twinning in martensite. M sub s temperature measurements showed that increasing the chromium level also lowers the M sub s temperature, and as expected the amount of autotempering during quenching decreased. NSA

N74-12275# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.
MAGNETIC FORM FACTORS OF Ni-Fe ALLOYS
L. Dobrzynski, O. J. Eder, F. Maniawski, A. Modrzejewski, E. Rossmanith, and D. Sikorska Feb. 1973 27 p refs
(SGAE-2092) Avail: AEC Depository Libraries HC $3.50

Magnetic form factors of three Ni-Fe alloys (14,21, and 50 at.% Fe) were measured by means of polarized-neutron diffraction. A comparison of the alloy form factors with the form factor of Ni is performed, and the asphericity, the spin density, and the changes in the symmetry of the spin density are discussed. Results for electronic-structure parameters from a comparison of experimental and theoretical form factors are presented.
Author (NSA)

N74-12276# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
COSMIC RAY FORMATION OF ALUMINUM 26
Jacques Tobailem, C. H. DeLassus St-Genies, and Hubert Reeves Jun. 1973 15 p refs In FRENCH
(CEA-R-4441) Avail: AEC Depository Libraries HC $3.00

Recent experimental data together with general lore on the behavior of similar spallation reactions were used to obtain full excitation curves for the formation of Al-26 in bombardment of magnesium, aluminium, silicon, and iron. These excitation functions were then averaged over various types of energy spectra applicable to relevant astrophysical contexts. It appears that, during galactic cosmic-ray bombardment of interstellar gas, the main contributor is silicon; while during early solar cosmic-ray bombardment of solar gas, the main contributor is magnesium, as well as during irradiation of meteoritic matter by solar and galactic cosmic rays. Author (NSA)

N74-12277# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
HIGH-TEMPERATURE RUPTURE
G. Sainfort 17 Jan. 1973 48 p refs In FRENCH Presented at Conf. on Studies on the Flow and Relaxation of Steels, Lyon, France, 5-7 Dec. 1972
(CEA-Conf-2187; CONF-721221-2) Avail: AEC Depository Libraries HC $4.50

The following points are discussed: empirical laws concerning the rupture time; metallographic observations; mechanisms associated with the germination and growth of intergranular cavities; effect of various parameters (temperature, amplitude and direction of the stress, hydrostatic pressure, composition and purity of the alloys, inter- and intragranular precipitation, environment and irradiation). NSA

N74-12278# Scientific Translation Service, Ann Arbor, Mich.
SOME LAWS GOVERNING THE EFFECT OF PRELOADING UNDER ALTERNATING TENSILE STRESSES ON THE CREEP STRENGTH OF Cr18Ni10Ti STEEL
E. M. Lyutii, G. G. Maksimovich, and S. V. Pagirnii [1973] 6 p refs Transl. into ENGLISH from Fiz.-Khim Mekhan. Materialov, Akad. Nauk Ukr. SSR (Kiev), v. 8, no. 4, 1972 p 32-35 Prepared for ORNL
(ORNL-TR-2691) Avail: NTIS HC $3.00

The effects of preloading under cyclic tensile stresses on the fatigue and creep strength of specimens of Cr18NilOTi steel were investigated. Prestressing under alternating tensile loads was conducted on a microtester with a directional vibrator in the air at 20 C, at 10,000 cycles (Omega sub w = 57.5 kg/sq mm) with an asymmetry coefficient of the cycle Rho = 0.2. The fatigue and creep strengths were determined at 600 and

700 C. It is shown that preloading for a definite time increases the creep strength of specimens, but with an increase in testing time the creep strength of stressed specimens becomes lower than that of the initial specimens. Author (NSA)

N74-12279# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
DEVELOPMENT OF FIBER REINFORCED METAL MATRIX COMPOSITES [ENTWICKLUNG FASERVERSTAERKTER VERBUNDWERKSTOFFE MIT METALLISCHER MATRIX]
Winfried Koehler, Enno VanRensen, and Karl Sahm Bonn Bundersmin. fuer Forsch. und Technol. Jul. 1973 122 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FBT-73-14) Avail: NTIS HC $8.25; ZLDI, Munich 25,20 DM

The fabrication and evaluation of both boron filament and whisker reinforced light metals is described. The filament reinforced composites were prepared by filament winding, plasma spraying, and hot pressing. The embedding and unidirectional orientation of whiskers in the metal is achieved by powder metallurgy and hot extrusion. The mechanical properties of the composites at room and elevated temperatures are discussed with ragard to wetting, chemical compatibility, fiber orientation, and fiber degradation. In the Borsic-Al system the measured tensile strength of about 150 kp/sq mm and Youngs' modulus of 23000 kp/sq mm are in agreement with the law of mixture. At temperatures above 200 C the tensile strength of aluminum reinforced with 15% Vol SiC whiskers exceeds the corresponding values of the pure matrix by a factor 2 to 3. Author (ESRO)

N74-12280# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
STUDY OF SOFT X-RAY APPEARANCE POTENTIAL SPECTROSCOPY FOR CHEMICAL ANALYSIS OF SURFACES Final Technical Report, Jun. - Dec. 1972
William L. Baun and Merrill B. Chamberlain Jun. 1973 36 p refs
(AF Proj. 7340)
(AD-766702; AFML-TR-73-71) Avail: NTIS CSCL 11/6

A soft X-ray appearance potential spectrometer (SXAPS) has been assembled, tested, and used to record spectra of selected materials for the purpose of studying the feasibility of routine elemental and chemical characterization of surfaces. These initial results demonstrate capabilities of SXAPS as a surface analysis tool and provide guidelines for the development of a more sensitive detection system for the technique. Characteristics of the SXAP spectrometer and criteria for the development of a detection system with an improved dynamic range of sensitivity are presented. Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N74-12281 Rensselaer Polytechnic Inst., Troy, N.Y.
THE THERMAL PROPERTIES OF POLYCRYSTALLINE AND GLASSY CARBON BELOW 4 K Ph.D. Thesis
Joseph Cloberry Williams, Jr. 1972 143 p
Avail: Univ. Microfilms Order No. 73-14218

The thermal conductivity from 0.4 K to 4.2 K of soft carbon samples heat treated to 1100 C, 1600 C, 2000 C, 2400 C, and 2800 C was measured. Samples of 600 C HTT soft carbon, Lockheed Missiles and Space Company 1000 Grade glassy carbon, and LMSC 2000 Grade glassy carbon were found to have plateau-type thermal conductivities in the range 0.4 K to 4.5 K. Such behavior is similar to that of glasses and polymers between 5 K and 10 K and indicates the amorphous nature of these carbons. Attempts have been made, unsuccessfully, to fit the lattice thermal conductivity and lattice specific heat of these carbons to current theories. Soft carbon heat treated to 2800 C has been found to make a good thermal switch for cryogenic applications as it has a very low thermal conductivity at helium temperatures, but a high thermal conductivity between helium and room temperatures. Dissert. Abstr.

N74-12282 Georgia Inst. of Tech., Atlanta.
COMBINED HEAT AND VAPOR TRANSPORT MECHANISMS IN A POROUS IMPREGNATED CERAMIC Ph.D. Thesis
Jerry R. Dunn 1972 145 p
Avail: Univ. Microfilms Order No. 73-14086

The primary objective of this investigation was to develop an analysis for the thermal response of a porous, transpiration cooled, thermal protection material which included the thermal and chemical coupling phenomena of the test environment and to compare these results with experimental measurements. A theory was developed for the transient temperature history of a porous ceramic, impregnated with a gelatine hydrate, subjected to the exhaust of an oxy-acetylene torch. The analysis considered the transient recession of the vaporizing impregnate interface and the resultant flow of water vapor through the porous matrix to the heated surface. Heat and vapor flow were assumed to be one dimensional in the direction normal to the heated surface with variable thermal conductivity and vapor specific heat on the heated side of the interface. The boundary condition at the heated surface included the effects of surface injection on the boundary layer profiles and included surface radiation and diffusion of gaseous species to and from the surface for thermal equilibrium among six chemical species: H2O, CO2, O2, CO, H2 and N2. Dissert. Abstr.

N74-12283*# National Research Corp., Billerica, Mass.
PROPERTIES OF VACUUM-EVAPORATED BORON FILMS
Frank Feakes Aug. 1973 82 p refs
(Contract NASw-2214)
(NASA-CR-136124) Avail: NTIS HC $6.25 CSCL 11D

The work on the properties of thin boron films made by vacuum evaporation of elemental boron using an electron beam as the energy source is reported. The program aimed at characterizing the properties of vacuum evaporated films. The work was directed toward those variables considered to be important in affecting the tensile strength of the boron films. In general, the thickness of the films was less than 0.002 in. The temperature of the substrate on which the boron was condensed was found to be most important. Three distinctly different forms of boron deposit were produced. Although the transition temperature was not sharply defined, at substrate temperatures of less than approximately 600 deg C the boron deposits were amorphous to X-ray. If the substrate were highly polished, the deposits were black and mirror-like. For substrates with coefficients of thermal expansion close to that of boron, the deposits were then continuous and uncracked. The studies suggest that the potential continues to exist for film-type composites to have both high strength and high modulus. Author

N74-12284*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SURFACE EMISSIVITY OF A REINFORCED CARBON COMPOSITE MATERIAL WITH AN OXIDATION-INHIBITING COATING
Roy M. Wakefield Oct. 1973 29 p refs
(NASA-TM-X-62315) Avail: NTIS HC $3.50 CSCL 11D

Total effective emissivity and spectral emissivity over the wavelength range of 0.65 to 6.3 microns were determined for temperatures from 1300 t0 2250 deg K. A multi channel radiometer was used in the arcjet and laboratory tests. The black-body-hole method was used to independently check radiometer results. The results show the silicon-carbide coated reinforced carbon composite material is a nongray radiator. The total effective emissivity and the spectral emissivity at 0.65 micron both decreased with increasing temperature, respectively, from approximately 0.8 to 0.6, and from 0.4 to 0.25, over the temperature range. The emissivity values were the same when the sample was viewed normal to the surface or at a 45 deg angle. Recommended emissivity values are presented. Author.

N74-12285*# Pratt and Whitney Aircraft, East Hartford, Conn.
IMPACT RESISTANCE OF COMPOSITE FAN BLADES Final Report

E. J. Premont and K. R. Stubenrauch May 1973 81 p
(Contract NAS3-16763)
(NASA-CR-134515; PWA-TM-4763) Avail: NTIS HC $6.25 CSCL 11D

The resistance of current-design Pratt and Whitney Aircraft low aspect ratio advanced fiber reinforced epoxy matrix composite fan blades to foreign object damage (FOD) at STOL operating conditions was investigated. Five graphite/epoxy and five boron/epoxy wide chord fan blades with nickel plated stainless steel leading edge sheath protection were fabricated and impact tested. The fan blades were individually tested in a vacuum whirlpit under FOD environments. The FOD environments were typical of those encountered in service operations. The impact objects were ice balls, gravel, stralings and gelatin simulated birds. Results of the damage sustained from each FOD impact are presented for both the graphite boron reinforced blades. Tests showed that the present design composite fan blades, with wrap around leading edge protection have inadequate FOD impact resistance at 244 m/sec (800 ft/sec) tip speed, a possible STOL operating condition. Author

N74-12286*# Kanner (Leo) Associates, Redwood City, Calif.
REACTION OF SPODUMENE WITH ALKALI SULFATES
B. Ye. Plyushchev Washington NASA Dec. 1973 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 124, 1959 p 642-645
(Contract NASw-2481)
(NASA-TT-F-15208) Avail: NTIS HC $3.00 CSCL 11D

If calcined Beta spodumene is sintered with K2SO4, Rb2SO4 or Cs2SO4, up to 1500 deg, Li2SO4 is formed by ion exchange and is easily leached from the sinter cake. The reaction is incomplete and yield is low with Na2SO4. Residual products are leucite, Rb leucite, and pollucite. Conversion with K2SO4 starts at 700 deg in the solid phase, and a melt phase forms above 1100 deg, reducing the Li in the soluble phase. Residual products were identified by X-ray diffraction amount of Li in the soluble phase. Residual products were identified by X-ray diffraction, optical and differential-thermal methods, the latter indicating enantiotropic inversion effects in leucite and Rb leucite, but no polymorphism in pollucite. Reaction of a 1:1 mix of spodumene and K2SO4 starts at 900-950 deg, but the yield is higher at higher temperatures. With NaSO4, a viscous glass soon forms, which inhibits and then stops the reaction. For this reason, the use of mixes of both sulfates or of waste salts is unsuitable. Instead of Beta spodumene concentrate, mine lumps or flotation concentrates can be used. Rapid conversion of the natural alpha into the high termperature Beta modification takes place in the sintering process itself. Author

N74-12287# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
A COMPILATION AND EVALUATION OF MECHANICAL, THERMAL, AND ELECTRICAL PROPERTIES OF SELECTED POLYMERS
R. E. Schramm, A. F. Clark, and R. P. Reed Sep. 1973 848 p refs
(AEC Order SAN-70-113)
(NBS-Monograph-132) Avail: SOD HC $10.25 Domestic Postpaid or $9.50 GPO Bookstore

This compilation abstracts original experimental data on the mechanical, thermal, and electrical properties of six commercially available polymers. After an extensive review of the open literature, all available data were collected together in graphical and tabular form along with material characterization, experimental method, and reference to the original publication. The data are also summarized and a brief description of each polymer is included. Author

N74-12288# Grumman Aerospace Corp., Bethpage, N.Y.
RADIATION-INDUCED LUMINESCENCE IN SOME OPTICAL MATERIALS: A SIMPLIFIED KINETIC ANALYSIS
J. Chang Sep. 1973 19 p
(RM-578) Avail: NTIS HC $3.00

The induced luminescence from the interaction of ionizing radiation with some inorganic oxides is investigated as a method of energy conversion. It is stated that the conversion is inversely correlated to induced coloration in the optical materials under radiation. An empirical model is developed to interpret the phenomena of induced coloration and luminescence. A kinetic treatment is given, emphasizing the limiting behavior of induced luminescence in the low intensity region. Author

N74-12289# Defence Research Establishment Valcartier (Quebec).
MATERIALS FOR IMPROVING INTERNAL SECURITY EQUIPMENT
H. P. Tardif Oct. 1973 72 p refs
(DREV Proj. 97-01-19)
(DREV-TN-2063/73) Avail: NTIS HC $5.75

A brief review is provided of the main materials used in the construction of equipment for the control of civil disturbances. This review is followed by a description of simple and of more complex material systems which form the basis of the specialized equipment used in riot control and security operations. Author

N74-12290# Massachusetts Inst. of Tech., Cambridge.
BASIS RESEARCH IN CRYSTALLINE AND NONCRYSTALLINE CERAMIC SYSTEMS Annual Report
W. D. Kingery and R. L. Voble 1973 65 p refs
(Contract AT(11-1)-3344)
(COO-3344-10) Avail: NTIS HC $5.25

Studies covered: (1) kinetics of phase changes, diffusion, and microstructure development, (2) relationship of properties to composition, crystal structure, and (3) materials synthesis and preparation. New, previously unreported results are given on: thermal gradient studies on UO2 and UO2-CeO2; growth of UO2 single crystals by chemical vapor transport using Cl2; review and analysis of ambipolar diffusion; defect structures in Al2O3; microstructural evolutions of two-phase Vycor glass-type (6%Na2O, 25% B2O3,67.8%SiO2) at 560 to 720 C; electric conductivity of amorphous Si after annealing; grain-boundary sliding in Al2O3 and other oxides; plausible concepts necessary and sufficient for interpretation of ceramic grain boundary phenomena; electric charges on grain boundaries in NaCl and oxides; solute-vacancy pair formation for XrO2 in MgO; and grain-boundary segregation and precipitation in Nd-doped Yttralox. NSA

N74-12291# Marvalaud, Inc., Westminster, Md.
EVALUATION OF DOG BONE FIBER COMPOSITES FOR USE IN WEAPON COMPONENTS Final Report
Alexander T. Fesolowich Jul. 1973 36 p refs
(Contract DAAF03-72-C-0005; DA Proj. 1W5-62604-A-607)
(AD-766284; AMSWE-R-RR-T-6-48-73) Avail: NTIS CSCL 11/6

A continuation of the dog bone fiber composite study has been focused on the examination of the behavior of these systems containing swollen-end 17-7 PH stainless steel fibers within a work-hardening matrix material and within a superplastic matrix material. Composites were produced in various volume percentages in a eutectoid aluminum-zinc alloy and in pure aluminum. Infiltration of the matrix material about the fibers presented the major barrier in this study. However, centrifugal casting proved to be a satisfactory solution to this problem. Results of tensile tests conducted at room temperature and at 500F showed that the ultimate strength varied directly with fiber density. The stainless steel fibers were found to fail without viscous interaction with the matrix. A discussion of how the strength of dog bone fibers in the composite is limited by geometrical constraints is given. Author (GRA)

N74-12646 Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
REVIEW OF ANOMALOUS SCATTERING OF PLZT CERAMICS OF HIGH LANTHANUM CONTENT
A. S. Khalafalla, D. Burbank, and J. Jurisson *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12647 Sandia Labs., Albuquerque, N.Mex.
ELECTRO-OPTIC DEVICES UTILIZING QUADRATIC PLZT CERAMIC ELEMENTS
J. Thomas Cutchen, J. O. Harris, Jr., and G. R. Laguna *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 12 p refs Sponsored by AEC (For availability see N74-12580

03-34)
Copyright.

N74-12648* Radiation, Inc., Melbourne, Fla.
PLZT BLOCK DATA COMPOSERS OPERATED IN DIFFERENTIAL PHASE MODE
M. D. Drake and D. E. Klingler *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
(Contract NAS8-26672)
Copyright.

N74-12649 Sandia Labs., Albuquerque, N.Mex.
SELF-LIMITING ELECTRO-OPTIC VARIABLE DENSITY FILTERS
D. G. Schueler and W. D. Smith *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs Sponsored by AEC (For availability see N74-12580 03-34)
Copyright.

N74-12650 Bell Telephone Labs., Inc., Whippany, N.J.
EVALUATION OF PLZT CERAMIC DISPLAY DEVICE FOR HIGH-SPEED INTERACTIVE DATA DISPLAYS
J. A. DiSabato and D. B. Fraser *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N74-12292 Cornell Univ., Ithaca, N.Y.
GEOMETRICAL DYNAMICS OF CERTAIN NONLINEAR CONSERVATIVE SYSTEMS WITH TWO DEGREES OF FREEDOM Ph.D. Thesis
Gopalakrishna Nadig 1973 119 p
Avail: Univ. Microfilms Order No. 73-14707

The geometrical dynamics, geometry of trajectories of dynamical systems in the manifold of configurations without explicit reference to their motion in the time domain, of a class of nonlinear conservative systems with two degrees of freedom is studied. The approximation of the nonlinear normal modal curves for the motion of a free particle on an arbitrary smooth surface is investigated under the influence of gravity. The metrical structure of the manifold is not assurmed to be of Euclidean form. The geometricodynamical equation governing the motion of the particle is derived using the principle of least action. A general class of two-degree-of-freedom conservative systems with a Riemannian manifold is discussed. A plane double pendulum oscillating freely under gravity best typifies this class of dynamical systems. The results are applied to several examples. The problem of the multiple centers of gravitation is discussed. Specifically, it deals with the planar motion of a particle subject to the attractive influences from a finite number of collinear, fixed Newtonian centers of force. Dissert. Abstr.

N74-12293 Illinois Univ., Urbana.
A FIELD METHOD FOR THE NUMERICAL INTEGRATION OF TWO POINT BOUNDARY VALUE PROBLEMS Ph.D. Thesis
Sammy Aaron Kiger 1972 58 p
Avail: Univ. Microfilms Order No. 73-17278

This investigation examines the use of a direct method of integrating a system of n second-order differential equations with n boundary conditions given at each end of the interval of definition. The method is based on the reduction of the given second-order system of differential equations into a system of $n(n+1)$ first-order differential equations to be integrated forward from the initial point of the interval to the terminal point of the interval, plus a second set of n first-order differential equations to be integrated backward from the terminal to the inital point of the interval. Numerical stability of the method is discussed and the method is generalized to include some nonlinear problems. Several examples are solved to illustrate the use of the method. Dissert. Abstr.

N74-12294# Sheffield Univ. (England). Dept. of Probability and Statistics.
SOME SELECTION RULES FOR COMPARING p PROCESSES WITH A STANDARD
U. D. Naik Jan. 1973 13 p refs
(RR-125/UDN-5) Avail: NTIS HC $3.00

Some rules are presented for comparing p processes with a standard process wherein each of these processes is characterized by two types of random variables x and y. We consider that x and y follow indepedent exponential distributions with means lambda and mu respectively, and a process can be designated as superior (inferior) to standard if its parameter (lambda/mu) is less (greater) than the parameter (lambda/mu) of the standard. Rules are given to decide which among the p processes are superior to standard and which are inferior. Author

N74-12295# Sheffield Univ. (England). Dept. of Probability and Statistics.
THE BAYESIAN PREDICTIVE DISTRIBUTION IN LIFE TESTING MODELS
I. R. Dunsmore Jun. 1973 14 p refs
(RR-138/IRD-1) Avail: NTIS HC $3.00

Prediction intervals for future observations in life testing situations have been derived. Expected-cover tolerance regions have been obtained. A Bayesian approach was given to such situations and the concept of the Bayesian predictive distribution was used. Both the exponential and the two-parameter exponential distributions were considered. Author

N74-12296*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A PARALLEL VARIABLE METRIC OPTIMIZATION ALGORITHM
Terry A. Straeter Washington Dec. 1973 23 p refs
(NASA-TN-D-7329; L-8986) Avail: NTIS HC $2.75 CSCL 12A

An algorithm, designed to exploit the parallel computing or vector streaming (pipeline) capabilities of computers is presented. When p is the degree of parallelism, then one cycle of the parallel variable metric algorithm is defined as follows: first, the function and its gradient are computed in parallel at p different values of the independent variable; then the metric is modified by p rank-one corrections; and finally, a single univariant minimization is carried out in the Newton-like direction. Several properties of this algorithm are established. The convergence of the iterates to the solution is proved for a quadratic functional on a real separable Hilbert space. For a finite-dimensional space the convergence is in one cycle when p equals the dimension of the space. Results of numerical experiments indicate that the new algorithm will exploit parallel or pipeline computing capabilities to effect faster convergence than serial techniques. Author

N74-12297*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT AND APPLICATION OF A LOCAL LINEARIZATION ALGORITHM FOR THE INTEGRATION OF QUATERNION RATE EQUATIONS IN REAL-TIME FLIGHT SIMULATION PROBLEMS
Lawrence E. Barker, Jr., Roland L. Bowles, and Louis H. Williams (Electronic Associates, Inc.) Washington Dec. 1973 58 p refs
(NASA-TN-D-7347; L-8954) Avail: NTIS HC $3.50 CSCL 12A

High angular rates encountered in real-time flight simulation problems may require a more stable and accurate integration method than the classical methods normally used. A study was made to develop a general local linearization procedure of integrating dynamic system equations when using a digital computer in real-time. The procedure is specifically applied to the integration of the quaternion rate equations. For this application, results are compared to a classical second-order method. The local linearization approach is shown to have desirable stability characteristics and gives significant improvement in accuracy over the classical second-order integration methods. Author

N74-12298# Joint Publications Research Service, Arlington, Va.
THE HYPERCOMP-80 TM SYSTEM FOR DIRECT MODELING OF COMPLEX SYSTEMS BY THE METHOD OF CONSIDERING GROUPS OF ARGUMENTS
S. F. Kozubovskyy and F.M. Vysotskyy 16 Nov. 1973 9 p refs Transl. into ENGLISH from Avtomatyka (Kiev), no. 4, 1973 p 84-89
(JPRS-60567) Avail: NTIS HC $3.00

The Hypercomp-80 TM system which is designed to solve problems requiring the application of linear or nonlinear multistage regression analysis (approximation of functions by power series - calculation of hyperplanes and hypersurfaces of the n'th degree is described. The operation is based on polynomial algorithms analogous to the algorithms which are employed in the known method of group taking account of arguments. The system works for both computation and control. The adaptive network, and its relation with the central processor, are described. The fields of application are also listed. T.M.R.

N74-12299# Grumman Aerospace Corp., Bethpage, N.Y.
ON A NUMERICAL SCHEME FOR SOLVING NONLINEAR BOUNDARY VALUE PROBLEMS WITH MIXED BOUNDARY CONDITIONS
Reuben R. Chow Nov. 1973 27 p refs
(RM-582) Avail: NTIS HC $3.50

A modification of Keller's box scheme for solving boundary value problems to cover cases with mixed boundary conditions is developed. Keller's scheme is a very efficient finite difference algorithm for solving systems of ordinary differential equations and systems of parabolic partial differential equations. The original method employed a block tridiagonal matrix formulation that was not directly applicable to problems with mixed boundary conditions. The present generalized method was applied to the solution of two boundary value problems that arise in the theory of laminar viscous interactions. The main program is used as the core in a number of other computer codes to solve a variety of viscous problems. A user-oriented FORTRAN 4 subroutine is also included for the solution of the present matrix system. Author

N74-12300# Loughborough Univ. of Technology (England). Dept. of Mathematics.
SINGULAR CONTROL OF DELAY SYSTEMS
M. A. Connor Jun. 1973 10 p refs
Avail: NTIS HC $3.00

The singular problem for systems represented by ordinary differential equations was studied. In particular, Jacobson's necessary condition for optimality of singular arcs was first derived using differential dynamic programming, and later using variational techniques. The approach of variational techniques is used to study the singular problem associated with differential-difference equations containing time lag elements. Author

N74-12301# Loughborough Univ. of Technology (England). Dept. of Mathematics.
THE USE OF DISCONTINUOUS TRIAL FUNCTIONS IN VARIATIONAL CALCULATIONS
J. Hyslop Aug. 1973 15 p refs
Avail: NTIS HC $3.00

Variational calculations are carried out for a certain class of self-adjoint differential equations, by re-formulating as an integral equation, using the Green's function. The integral and differential variation formulations are compared and the former is shown to be superior in that, for a given trial function, it provides lower upper bounds for the lowest eigenvalue. It is noted that rapidly converging lower bounds also arise naturally from the integral equation. The use of discontinuous trial functions is then discussed and illustrative numerical results presented. Author

N74-12302# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A CONTRIBUTION TO THE RAINICH THEORY OF THE NEUTRINO FIELD 2
J. B. Griffiths Jul. 1973 14 p refs
Avail: NTIS HC $3.00

Conditions are given on the metric of a space-time for it to admit a neutrino-gravitational field. The method described involves comparing the spin coefficients of a suitably defined tetrad of null vectors. It is used to obtain the class of space-times which admits a neutrino field or a non-null electromagnetic field. The classes of space-time which admit two different neutrino fields are also described. Author

N74-12303# Loughborough Univ. of Technology (England). Dept. of Mathematics.
AN EXTENSION OF BALAKRISHNAN'S EPSILON-METHOD TO SYSTEMS OF NEUTRAL TYPE
M. A. Connor Aug. 1973 27 p refs
(Mathematics-Research-28) Avail: NTIS HC $3.50

The Balakrishnan epsilon method for the solution of optimal control problems is extended to systems represented by neutral equations. A constructive derivation of a maximum principle for the problem considered is presented. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N74-12304*# California Univ., Los Angeles. Dept. of Meteorology.
INTERACTION OF A CUMULUS CLOUD ENSEMBLE WITH THE LARGE-SCALE ENVIRONMENT
A. Arakawa and W. Schubert Jun. 1973 66 p refs
(Grant NGR-05-007-328)
(NASA-CR-136106) Avail: NTIS HC $5.50 CSCL 04B

Large-scale modification of the environment by cumulus clouds is discussed in terms of entrainment, detrainment, evaporation, and subsidence. Drying, warming, and condensation by vertical displacement of air are considered as well as budget equations for mass, static energy, water vapor, and liquid water. F.O.S.

N74-12305# National Environmental Satellite Center, Washington, D.C.
APPLICATION OF METEOROLOGICAL SATELLITE DATA IN ANALYSIS AND FORECASTING
Ralph K. Anderson and Arthur H. Smith Nov. 1971 66 p refs
(ESSA-TR-NESC-51-Suppl; AWS-TR-212) Avail: SOD HC $0.65

The basic characteristics of infrared data obtained from long wave radiation emitted from cloud, land, and water surfaces are given along with the temperatures of the surfaces viewed. Interpretation of cloud forms and surface features are shown with a comparative presentation of IR imagery and TV pictures. The scanning radiometer (SR) and its spatial resolution, limb darkening, temperature resolution of the SR, computer processed IR data, and the enhancement of IR imagery are discussed. T.M.R.

N74-12306# Bureau of Meteorology, Melbourne (Australia). Australian National Antarctic Research Expeditions.
METEOROLOGY: MACQUARIE ISLAND, MAWSON AND WILKES, 1968
1972 403 p
(Publ-118) Avail: NTIS HC $22.25

Climatological summaries are presented for Macquarie Island, Mawson, and Wilkes for 1968. Author

N74-12307# Secretariat General a l'Aviation Civile, Paris (France).
CLIMATOLOGY OF THE AIRPORT OF TAHITI-FAAA [CLIMATOLOGIE DE L'AEROPORT DE TAHITI-FAAA]
G. Cauchard, R. Leymarie, J. Bacara, and R. Maginiez Apr. 1973 62 p In FRENCH
(Monographie-87) Avail: NTIS HC $5.25

Evaluation of year round meteorological measurements for the Society Islands establishes a steady predominant east wind pattern with an air mass flow subject to occasional tropical depressions of short durations. These meteorological conditions

cause some aeronautical problems that require flight cancellations or delays at Tahiti airport. However, the few observed bad weather conditions rarely necessitate rerouting of airplanes.
Transl. by G.G.

N74-12308# Scientific Translation Service, Santa Barbara, Calif.
FUNDAMENTAL RESEARCH WORK IN JAPAN ON DUST COLLECTORS
Koichi Iinoya [1973] 18 p refs Transl. into ENGLISH from Proc. of Intern. Symp. on Air Pollution (Tokya), 17-19 Oct. 1972 p 233-250 Sponsored by EPA
(APTIC-47240; TR-455-73) Avail: NTIS HC $3.00
The general review of fundamental research on dust collectors includes theories and experiments regarding the various types of equipment. Fairly considerable results are reported on cyclones, fibrous filters, and the Benchly scrubber. Also studied are bag filters and their cyclic performance as well as mist separators.
G.G.

N74-12309# Scientific Translation Service, Santa Barbara, Calif.
HYGIENIC EVALUATION OF OXIDES OF NITROGEN AS ATMOSPHERIC POLLUTANTS
V. A. Popov [1973] 8 p refs Transl. into ENGLISH from Gigiena i Sanit. (Moscow), no. 5, May 1972 p 77-81 Sponsored by the EPA
(APTIC-42326; TR-271) Avail: NTIS HC $3.00
The biological effects of nitrogen oxides in air were studied. The sources of nitrogen oxide pollution are discussed along with concentrations. It was found that in concentrations from 1.5 to 94 mg/cu m, the frequency of respiration increases, and the volume of inspired air in animals is reduced. It is suggested that pulmonary emphysema is promoted by nitrogen dioxide.
F.O.S.

N74-12310# Kanner (Leo) Associates, Redwood City, Calif.
CONCERNING SAMPLING OF AIRBORNE IODINE FOR RADIATION MONITORING
Mitsuo Naritomi and Seiji Fukuda Jan. 1973 42 p refs Transl. into ENGLISH from Kuki Seijo (Japan), v. 10, no. 2, Jun. 1972 p 79-94 Sponsored by Environ. Protection Agency
(APTIC-43785; TR-310-73) Avail: NTIS HC $4.25
Samplers and monitors with active carbon collectors are considered for detecting airborne iodine fission products resulting from reactor accidents. Experiments show that the collection efficiency of these collectors depends on the properties of the airborne iodine, the state of the atmosphere, and the place of installation in the working environment. Iodine concentration evaluation in heated air samples shows a precision of within plus or minus 10% for a sampler consisting of dust collecting and active carbon filter papers, and a precision of plus or minus 3% for a sampler consisting of dust collecting and active carbon filter papers in addition to two active carbon cartridges; even if the airborne iodine consists of 80% organic iodine and 20% inorganic iodine subjected to 100% atmospheric humidity, a precision concentration evaluation of about 5% is obtained by the first filtering method and of about 1% with the CHC-50 active carbon cartridge method. G.G.

N74-12311# Kanner (Leo) Associates, Redwood City, Calif.
DISPERSION OF POLLUTION IN THE ATMOSPHERE
Nagayuki Yokoyama Apr. 1973 12 p refs Transl. into ENGLISH from the publ. "Research Lecture Meeting" Japan, Ind. Sci. and Technol. Agency, 6 Oct. 1971 Sponsored by Environ. Protection Agency
(APTIC-35747; TR-499-73) Avail: NTIS HC $3.00
Movement and dispersion of atmospheric pollutants are estimated according to scales of measurement, structure of dispersion area, and methods of pollution forecast. Considered are the dispersion within stable and uniform atmospheric boundary layers and the effects of meteorological conditions on dispersion. A calculation method by simple dispersion formula, a method by differential dispersion equations, and wind tunnel experiment data are used for forecasting atmospheric pollution from a discharge source. G.G.

N74-12312# Scientific Translation Service, Santa Barbara, Calif.
ATMOSPHERIC DIFFUSION MODELS AS COUNTERMEASURES FOR AIR POLLUTION
N. Yokoyama [1973] 20 p refs Transl. into ENGLISH from To Gai (Japan), v. 7, no. 4, Jul. 1972 p 125-133 Sponsored by Environ. Protection Agency
(TR-433-73; APTIC-44211) Avail: NTIS HC $3.00
The current status of diffusion models is reviewed, and their use in determining atmospheric pollution from industrial exhaust gases, air pollution in the cities, photochemical smog, and thermal pollution is discussed. The various classifications of these models are described and particular emphasis is placed on the box, plume, and puff models which take into consideration the physical process of diffusion and have the potential to raise the accuracy of future predictions. D.L.G.

N74-12313# Scientific Translation Service, Santa Barbara, Calif.
DISPERSION OF ATMOSPHERIC POLLUTANTS
O. Yokoyama [1973] 19 p refs Transl. into ENGLISH from Sekiyu Gakkai-shi (Tokyo), v. 15, no. 7, Jul. 1972 p 573-577 Sponsored by Environ. Protection Agency
(TR-435-73; APTIC-44088) Avail: NTIS HC $3.00
The behavior of pollutants in the atmosphere is examined for the control of atmospheric pollution. Dispersion flow, the flow of pollutants by means of air currents, and photochemical reactions are discussed for the establishment of countermeasures. Statistical and transport theories of atmospheric diffusion are given along with atmospheric diffusion experiments. Surveys of atmospheric pollution and pollution control are presented. Some future problems are cited for pollutants in the atmosphere over distances of 10 to 20 km. T.M.R.

N74-12314# Kanner (Leo) Associates, Redwood City, Calif.
FLUORIDES AND CHLORIDES IN PRECIPITATION IN BOHEMIA
Roman Valach Apr. 1973 22 p refs Transl. into ENGLISH from Studia Geophys. Geodaet., Ceskoslov. Akad. Ved. (Prague), v. 2, 1967 p 241-251 Sponsored by Environ. Protection Agency
(TR-531-73; APTIC-23862) Avail: NTIS HC $3.25
The fluoride and chloride content of precipitation samples was determined. The results disclosed that these concentrations came mostly from ash in contaminated samples, and mostly from the air in uncontaminated samples. F- and Cl- concentrations were not influenced by the intensity of coal combustion. The Cl/F ratio had a value of about 10 in precipitation, of e.g. 6 in the large natural volcanic sources, and 10000 in sea water. Therefore, it cannot be ruled out that precipitation in central Europe contains volcanic halides. A thorough investigation of the correlations between F(-), Cl(-), SO4(--), and Na concentrations in precipitation have both theoretical and practical importance, since hygienic, agricultural, meteorological, and other influences of fluorides and chlorides must be considered. Author

N74-12315# Scientific Translation Service, Santa Barbara, Calif.
STUDY ON FORECASTING SO2 POLLUTION FROM METEOROLOGICAL DATA
[1973] 113 p refs Transl. into ENGLISH of "Kishoyoso Karano Aryusan Gaso Osen No Yosokuni Kansuru Kenkyu", Tokyo Metropol. Public Hazard Lab., report, Nov. 1970 p 1-101 Sponsored by Environ. Protection Agency
(TR-346-73; APTIC-28297) Avail: NTIS HC $7.75
Qualitative statistical evaluation of measured atmospheric parameters shows that the location of high atmospheric pressure, low wind velocity, atmospheric pressure distribution, and movements of low atmospheric pressure areas affect SO2 air pollution over Tokyo. Evening predictions of SO2 pollution require a revision at 9:00 the following day. G.G.

N74-12316# Kanner (Leo) Associates, Redwood City, Calif.
AIR. A. PROPERTIES OF AIR
Arnold Heller and Erdwin Lahmann Apr. 1973 175 p refs Transl. into ENGLISH from Handb. Lebensmittelchem. (Berlin), v. 8, 1969 p 1242-1318 Sponsored by Environ. Protection Agency

(TR-500-73; APTIC-35455) Avail: NTIS HC $10.75

Starting from the normal composition of an unpolluted atmosphere the report deals in exhaustive detail with the various air pollutants, their origins, prevalence, toxic effect on humans, animals, and plants as well as their interrelationships. Vast amounts of data have been complied in the form of 34 tables, 6 illustrations, and numerous diagrams and documented by an extensive bibliography. Conditions described cover Germany, other European countries, the United States of America, and the Soviet Union. Author

N74-12317*# Aeronautical Research Associates of Princeton, Inc., N.J.

SURVEY ON EFFECT OF SURFACE WINDS ON AIRCRAFT DESIGN AND OPERATION AND RECOMMENDATIONS FOR NEEDED WIND RESEARCH Final Report, Dec. 1971 - Aug. 1973

John C. Houbolt Washington NASA Dec. 1973 79 p refs (Contract NAS8-28136)

(NASA-CR-2360; ARAP-194) Avail: NTIS HC $3.75 CSCL 04B

A survey of the effect of environmental surface winds and gusts on aircraft design and operation is presented. A listing of the very large number of problems that are encountered is given. Attention is called to the many studies that have been made on surface winds and gusts, but development in the engineering application of these results to aeronautical problems is pointed out to be still in the embryonic stage. Control of the aircraft is of paramount concern. Mathematical models and their application in simulation studies of airplane operation and control are discussed, and an attempt is made to identify their main gaps or deficiencies. Key reference material is cited. The need for better exchange between the meteorologist and the aeronautical engineer is discussed. Suggestions for improvements in the wind and gust models are made. Author

N74-12318# Australian Post Office Research Labs., Melbourne.

SOLAR RADIOMETER STUDIES OF TROPICAL RAIN ATTENUATION AT 11 GHz: INITIAL RESULTS

G. F. Jenkinson Jul. 1973 15 p ref

(Rept-6822) Avail: NTIS HC $3.00

Initial results of rain attenuation measurements at 11 GHz, using a solar radiometer, are given. The measurements are in a region of very high rainfall, and cover the period November 1972 - April 1973. From the results, interim values for rain attenuation margins at 11 and 14 GHz are estimated for an Australian satellite communication system. Meteorological data are used to extrapolate attenuation statistics to other areas of Australia. This extrapolation is for guidance only. Author

N74-12319*# Linguistic Systems, Inc., Cambridge, Mass.

AGROMETEOROLOGICAL METHODS FOR FORECASTING AND ESTIMATING CROP YIELD

Yu. I. Chirkov Washington NASA Nov. 1973 17 p Transl. into ENGLISH of "Agrometeorologichskiye Metody Prognoza i Otsenki Produktivnosti S. Kh. Kultur", WHO, Braunschweig, West Germany, Oct. 1973 13 p

(Contract NASw-2482)

(NASA-TT-F-15192) Avail: NTIS HC $3.00 CSCL 04B

Agrometeorological methods for forecasting and estimating the yield of corn and winter and spring wheat crops have been worked out and are in routine use in the U.S.S.R. Methods of selection of predictors, the forms of the prognostic equation, and various ways of revising the forecasts are presented. Improvement of the methods in use is discussed. Author

N74-12320# Scientific Translation Service, Santa Barbara, Calif.

THE DIFFUSION OF SMOKE IN THE EKMAN LAYER

S. Yamamoto and O. Yokoyama 1973 13 p refs Transl. into ENGLISH from Kogai (Japan), v. 7, no. 4, Jul. 1972 p 153-159 Sponsored by EPA

(APTIC-44365; TR-434-73) Avail: NTIS HC $3.00

Diffusion of stack gas plume in the atmospheric boundary layer, Ekman layer, is affected considerably by the vertical profile of wind direction and speed. Particularly, the effect of directional wind shear becomes very important for large scale diffusion. The effects of this wind shear on the diffusion are considered qualitatively by using the profiles of wind velocity and diffusion coefficient in the Ekman layer for stable, neutral and unstable conditions. The results of the computations are compared with some experimental data. Main results are summarized as follows: (1) The shearing effects increase its effects at long leeward and cross wind distance. (2) The shearing effects are particularly important for stable and neutral conditions. (3) Shape of lateral-vertical cross section of the plume shows a very peculiar pattern like an inclined pear shape. (4) The results of computations are consistent with experiment. Author

N74-12321# Kanner (Leo) Associates, Redwood City, Calif.

PRESENT AIR POLLUTION SITUATION IN KAWASAKI CITY AND FUTURE COUNTERMEASURES

Motoji Terabe Apr. 1973 22 p Transl. into ENGLISH from Kuki Seijo (Tokyo) v. 10, no. 5, Oct. 1972 p 66-71 Sponsored by Environ. Protection Agency

(KS-27; APTIC-47644) Avail: NTIS HC $3.25

The concentration of air pollutants and their effects are reported for Japan from 1965 through 1971. The present situation, in regards to sulfurous acid gas pollution, is discussed along with the future countermeasures. The air pollutants include: combustable products, leads, nitrogen oxides, ozones, organic peroxides, carbon monoxide, and hydrocarbons. The smoke producing facilities are listed along with the amounts of fuels used and the amounts of sulfurous gas acids produced. The occurrences of photochemical smog, dust fall, automobile gas exhausts, and the illnesses caused by these pollutants are also discussed. T.M.R.

N74-12322# Kanner (Leo) Associates, Redwood City, Calif.

CURRENT AIR POLLUTION SITUATION IN OSAKA

Toshio Hasegawa Apr. 1973 42 p Transl. into ENGLISH from Kuki Seijo (Tokyo), v. 10, no. 5, Oct. 1972 p 53-65 Sponsored by Environ. Protection Agency

(KS-26; APTIC-47661) Avail: NTIS HC $4.25

A survey is reported of air pollution for Osaka and its surroundings. Topics discussed include: topography and weather, amounts of fuels used and amounts of sulfurus acid gas discharged, sulfur oxides, floating dust, lead, and carbon monoxide. F.O.S.

N74-12323# Translation Consultants, Ltd., Arlington, Va.

THE ECONOMIC EFFECTS OF SULFUR DIOXIDE GAS ON FORESTS

I. Sano [1973] 13 p ref Transl. into ENGLISH from Kuki Seijo (Japan), v. 9, no. 6, 1972 p 80-83 Sponsored by Environ. Protection Agency

(TR-233-73; APTIC-39114) Avail: NTIS HC $3.00

The trees in the Sudbury Region suffer damage throughout the four seasons from sulfur dioxide gas that is emitted from the refineries. An area of approximately 720 cu miles around the refineries constitutes the heavy damage district. As sulfur dioxide gas wounds the foliage, it interferes with physiological functions and causes a reduction in the quantity of photosynthetic substances produced. Accordingly, the development of the foliage slows down, decreasing the development of trees diameter and increasing the death rates. The reduction in volumetric growth was calculated from the 10-year growth record of 7-12 inch diameter at breast height class white pine in the most heavily damaged districts. From these results it was clear that the estimated economic loss to forest owners and lumber manufacturers in the Sudbury region has been on the order of $117,100.00 annually. Author

N74-12324# Kanner (Leo) Associates, Redwood City, Calif.

CADMIUM IN THE AIR ATMOSPHERE OF TEN SELECTED CITIES IN POLAND

Jan Just and Jadwiga Kelus Dec. 1972 12 p refs Transl. into ENGLISH from Roczn. PZH (Warsaw), v. 22, no. 3, 1971 p 249-256 Sponsored by Environ. Protection Agency

(TR-284-73) Avail: NTIS HC $3.00

The cadmium content in air dust collected using the aspiration method as well as the cadmium concentration in the air of ten cities in Poland were determined. The cadmium content which was determined in the dust in air in 1967 showed that this content ranged from 0.002% to 0.018%. These values which were calculated for microgram 1cu m of air showed that the

cadmium concentration is highest in the air in Katowice (0.051 microgram/cu m) and lowest in Gdansk (0.002 microgram/cu m). Author

N74-12325# Kanner (Leo) Associates, Redwood City, Calif.
CONCERNING METHODS OF MEASURING SUSPENDED PARTICULATES IN THE ATMOSPHERE
Mitsugi Hitokatse, Koyama Taihachiro, Nakagawa Yoshihiro, Kosaka Hiroshi, Takata Nobuhiro, and Watanabe Hiroshi Jan. 1973 14 p refs Transl. into ENGLISH from Hyogo-Ken Kogai Kenkyujo Kenkyu Hokoku (Japan), no. 3, 1972 p 1-7 Sponsored by EPA
(TR-290-73; APTIC-42630) Avail: NTIS HC $3.00

The methods considered for measuring suspended particulates in the atmosphere are classified in the following categories: (1) methods for counting the number of the particulates (counting method); (2) methods for seeking the weight concentration (weight method); and (3) methods for seeking the relative concentration by spots on filter paper produced by air which has been taken in by suction (relative concentration method). The chief devices which are in actual use at the present time are high volume samplers and digital dust indicators. The former have the advantage that the components of the contents can be analyzed by sampling over a relatively short time. In the latter, measured values can be obtained every hour, and are convenient for constant monitoring of suspended particulates. The amount of suspended particulates which can be collected by high volume samplers was studied along with samplers for collecting respirable dust, which is important in evaluating the effects on the human body. The findings concerning the properties of the various types of samplers are reported. Author

N74-12326# Mundus Systems Inc., Washington, D.C.
CONCERNING PHOTOCHEMICAL SMOG IN TOKYO
[1973] 47 p Transl. into ENGLISH from Tokyo Metrop. Res. Inst. of Environ. Protec. (Japan), 1970 34 p Sponsored by EPA
(TR-206-73; APTIC-27194) Avail: NTIS HC $4.50

The smog incident, which occurred on July 18th and the following few days in 1970 over a wide area of Metropolitan Tokyo, drew the immediate attention of the public. However, there are many unknown factors about photochemical smog and its true nature is difficult to understand. In Tokyo the concentration of oxidants has been monitored since March 1967 at the Tokyo Metropolitan Research Institute of Hygiene as a part of the National Air Pollution Measurement Network, and some results of the measurements have been accumulating. The characteristics of pollution in past photochemical smog events are reported, a method of measurement of oxidants outlined and prediction of photochemical smog drawn from the results. Author

N74-12327# Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany).
MEASUREMENT OF AIRBORNE RADIOACTIVITY AND ITS METEOROLOGICAL APPLICATION, PART 3 Annual Report, 1 Apr. 1971 - 31 Mar. 1972
R. Reiter, R. Sladkovic, K. Poetzl, and H. J. Kanter Feb. 1973 172 p
(Contract AT(11-1)-3425)
(COO-3425-7-Pt-3) Avail: NTIS HC $10.75

Initial definite results obtained by a previously described method of studying the exchange of air masses between stratosphere and troposphere are presented. The physical measuring techniques were considerably improved and the radionuclides Be-7, P-32, P-33, S-35, and the fallout heavy metals are now measured with adequate accuracy. A continuous meteorological analysis was made for a period of 49 days. By comparing the condition of the atmosphere during intervals with an influx of stratospheric air to a fixed point on the earth's surface against the condition of the atmosphere during intervals without such influx, a number of indicators were developed which both characterize stratospheric-tropospheric exchange well, and contain a forecasting potential. Author (NSA)

N74-12328# World Meteorological Organization, Geneva (Switzerland).
THE EFFECT OF THERMOMETER SCREEN DESIGN ON THE OBSERVED TEMPERATURE
W. R. Sparks 1972 114 p refs
(WMO-315) Avail: NTIS HC $7.75; WMO, Geneva

Those aspects of thermometer screen design, exposure, and use that affect the temperature measured in a screen are reviewed. Identical instruments are compared and characteristics of forced ventilated screens as opposed to traditional naturally ventilated screens are discussed. Factors affecting temperature distribution are examined. The essential features of a well designed screen are given. Recommendations on the definition of air temperature for routine meteorological use, use of the Reference Psychrometer as a reference instrument, and comparison by WMO members of this reference instrument are given. ESRO

N74-12329# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
MONTHLY REVIEWS OF THE VLF ATMOSPHERICS ACTIVITY AUTOMATICALLY RECORDED DURING 1971 IN BERLIN-WAIDMANNSLUST BY MEANS OF THE VLF-ATMOSPHERICS-ANALYZER AND AN ADDITIONAL RECORDING SET
Guenter Heydt 18 Feb. 1972 24 p refs Sponsored in part by Deut. Forschungsgemeinschaft
(TB-149) Avail: NTIS HC $3.25

A description is given of auxiliary equipment to record monthly reviews on the VLF-Atmospherics activity as function of the azimuth and of the time of day by means of the VLF-Atmospherics-Analyser VLFAA 70. A coarse distinction between near and far atmospherics sources is made possible by classification of the group delay differences of the atmospherics. Monthly reviews of December 1970 and of all months of 1971 recorded in Berlin-Waidmannslust are shown and some comments on them are given. Author (ESRO)

N74-12330# World Meteorological Organization, Geneva (Switzerland).
FIFTH SESSION OF COMMISSION FOR AERONAUTICAL METEOROLOGY Abridged Final Report
1972 180 p Conf. held at Geneva, 4-16 Oct. 1971
(WMO-322) Avail: NTIS HC $11.00; WMO, Geneva

The developments in the field of aeronautical meteorology over the past four years are reviewed, with the emphasis on new problems caused by trends in civil aviation stressed. Activities are summarized in the areas of: training and qualifications of aeronautical meteorological personnel; briefing and documentation practices; terminal forecasting; clear air turbulence; supersonic transport, and application of satellite meteorology to aviation. ESRO

N74-12331# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC POLLUTION, SMOKE, AND SULFUR DIOXIDE Monthly Bulletin, Nov. 1972 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX BULLETIN MENSUEL, NOVEMBRE 1972]
Nov. 1972 29 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiol.
Avail: NTIS HC $3.50

Data obtained at Belgian weather stations are tabulated. The air pollution apparatus is briefly described. ESRO

N74-12332# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Jul. 1973 [OBSERVATIONS CLIMATOLOGIQUES, JUILLET 1973]
Jul. 1973 15 p In FRENCH and DUTCH
Avail: NTIS HC $3.00

Meteorological parameters observed at different Belgian weather stations during July 1973 are given. ESRO

N74-12333# World Meteorological Organization, Geneva (Switzerland).
THE AIR-MASS TRANSFORMATION EXPERIMENT Global Atmospheric Research Program
Jul. 1973 70 p refs Prepared jointly with Intern. Council of Sci. Unions
(GARP-Publ-13) Avail: NTIS HC $5.50; WMO, Geneva

The need for experiments on air-mass transformation and

clarification of their characteristics are briefly reviewed. The scientific objectives of AMTEX (air-mass transformations experiment) are considered and the scientific requirements are presented to make clear the characteristics of four problems: surface fluxes; convergence and divergence of the fluxes in the planetary boundary layer; convective clouds and the relationship between generation of meso- and medium scale disturbances, and energy supply from the underlying surfaces. The synoptic climatology of the AMTEX area around the SW Islands of Japan is discussed. Observational methods for determining the surface fluxes are outlined and parameterization techniques for large scale motion models are presented. The heat budget over the AMTEX area is described, and the relationship between the convective transport and cumulus convection discussed. A brief summary of the AMTEX experiment is given. ESRO

N74-12334# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Flugtechnik.
RESULTS OF STATISTICAL EVALUATION OF GUST MEASUREMENTS [ERGEBNISSE EINER STATISTISCHEN AUSWERTUNG VON BOENMESSUNGEN]
Manfred Zindel 17 May 1972 128 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft
(IFD-2/72) Avail: NTIS HC $8.50

The matrix autocovariance function, the matrix autocorrelation function, and the power spectra of the three components was determined for a number of vectorial gust events, measured from a mast 80 mm above ground. The analysis covers the wavelengths between 24 m and 2400 m and is related to a typical case. The theoretical background is reviewed. ESRO

N74-12335# Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY, NO. 8, 1973
26 Oct. 1973 118 p refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 1-111
(JPRS-60373) Avail: NTIS HC $8.00

Weather forecasting and climatic control methods are considered with applications to hydrometeorological effects on microclimate and agriculture. For individual titles, see N74-12336 through N74-12350.

N74-12336 Joint Publications Research Service, Arlington, Va.
NUMERICAL SIMULATION OF PROCESSES IN AN UNSTABLE ATMOSPHERE AND IN CONVECTIVE CLOUDS WITH VARIATION OF THE WIND WITH ALTITUDE
S. L. Lebedev *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 1-11 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 3-11 (For availability see N74-12335 03-20)

A study was made of atmospheric convection with variation of the wind with altitude. The corresponding system of equations, the boundary conditions and initial conditions are presented. An example solution is given. The values characterizing the atmosphere and the convective clouds in it are defined as the functions of three spatial coordinates and time. Author

N74-12337 Joint Publications Research Service, Arlington, Va.
PROCEDURE FOR NUMERICAL FIVE DAY FORECASTING OF THE TOTAL PRECIPITATION AND RESULTS OF TESTING IT
A. L. Kats and M. N. Fedulova *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 12-20 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 12-18 (For availability see N74-12335 03-20)

The results of improvement and operative testing of the model for numerical five day precipitation forecasting, using 24 to 72 hour hydrodynamic forecasting maps, are presented. The basis for the model is the hypothesis of the relation of the five day precipitation totals averaged over some area to the large scale characteristics of the circulation for the same five day period. Predominance of the meridional S form process in a macroprocess sample calculation for the greater part of the European territory produced five day precipitation forecasts that are satisfactory. G.G.

N74-12338 Joint Publications Research Service, Arlington, Va.
STATISTICAL CHARACTERISTICS OF THE OUTGOING RADIATION FIELD c13
L. A. Pakhomov, L. A. Pakhomova, and N. G. Markin *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 21-28 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 19-25 (For availability see N74-12335 03-20)

The statistical structure of the outgoing radiation fields above different natural surfaces were studied by aircraft measurements. Author

N74-12339 Joint Publications Research Service, Arlington, Va.
SOME CHARACTERISTICS OF STRATIFORMIS CLOUDS
Z. A. Devyatova *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 29-38 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 26-33 (For availability see N74-12335 03-20)

An aircraft sounding study was made of the characteristic features of the vertical temperature distribution in intramass single layered Sc, St clouds and near their boundaries. The distributions of the specific humidity, water content and also the form of the upper surface of these clouds were investigated. Author

N74-12340 Joint Publications Research Service, Arlington, Va.
CONSIDERATION OF NONADIABATIC FACTORS WHEN ESTIMATING THE HEIGHT OF THE LOWER BOUNDARY OF LOW STRATIFORMIS CLOUDS
B. P. Kudryavtsev *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 39-46 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 34-40 (For availability see N74-12335 03-20)

The presence of a clear annual behavior of the mean altitude of the lower boundary of stratocumulus clouds with a fixed ground dewpoint deficit is established. An explanation is given for the indicated phenomenon based on consideration of the effect of nonadiabatic factors. A new universal formula with a variable condensation degree is proposed for forecasting the altitude of the lower boundary of stratocumulus clouds by the expected ground dewpoint deficit and for diagnosing this altitude in the absence or impossibility of using the corresponding technical media. Author

N74-12341 Joint Publications Research Service, Arlington, Va.
SOME RESULTS OF OBSERVING ATMOSPHERIC OZONE IN CAIRO IN 1967-1969 c13
Z. Metvalli *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 47-53 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 41-45 (For availability see N74-12335 03-20)

The annual behavior of the total ozone content over Cairo was obtained with a peak in April and a minimum in October. The annual amplitude reached 14 percent of the mean annual ozone content. The correlation coefficients for the total content of ozone related to the temperature at the 100 millibar level and the altitude of the tropopause were calculated. It was demonstrated that the correlation of the ozone with the altitude of the tropopause is negative and is closest in the spring. A study was made of the variations of the total ozone in the atmosphere in cyclones and anticyclones. The total amount of ozone decreased on passage of the anticyclone and increased on passage of the cyclone. Author

N74-12342 Joint Publications Research Service, Arlington, Va.
EFFECT OF THE TEMPERATURE CONDITIONS IN THE SPRING AND NITROGEN SIDE DRESSING ON THE GROWTH, DEVELOPMENT AND YIELD OF WINTER WHEAT AND RYE c04
A. I. Korovin and V. M. Mokiyevskiy *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 54-60 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 78-83 (For availability see N74-12335 03-20)

Data are presented on the effect of the temperature conditions of the spring period and nitrogen side dressing on the growth, development and yield of winter wheat and rye. Individual conclusions can serve as a recommendation for nitrogen side dressing in the spring in connection with weather conditions. Author

N74-12343 Joint Publications Research Service, Arlington, Va.
EVALUATION OF PHYTOCLIMATE OF BARLEY AS A COVER CROP FOR RED CLOVER WITH HIGHLY DEVELOPED AGROTECHNICS **c04**
V. F. Panina *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 61-66 Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 84-88 (For availability see N74-12335 03-20)

Some results from observations of the phytoclimate of barley and the effect of the agrometeorological conditions on the growth and development of red clover covered by the barley are discussed. The basis is presented for recommendations with respect to the agrotechnics of barley as a cover crop for clover. Author

N74-12344 Joint Publications Research Service, Arlington, Va.
STUDY OF THE STRUCTURE OF TURBULENCE IN THE GROUND LAYER OVER LAKE BAYKAL
P. G. Kovadlo, V. I. Ivanov, and Sh. P. Darchiya *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 67-71 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 89-92 (For availability see N74-12335 03-20)

Variations of the correlation functions and spectral densities of the temperature pulsations per day with low cloud weather are used to analyse the interactions of air masses over dry land and the water surface of Lake Baykal. It is demonstrated that for the coastal zone, alternation of the radiation heating of the ground layer and the advective influx of cold air from the lake is characteristic. The peculiarities of the turbulent conditions in the ground layer are described. Author

N74-12345 Joint Publications Research Service, Arlington, Va.
DISTRIBUTION OF THE RECURRENCE RATES OF RELATIVE HUMIDITY IN THE FREE ATMOSPHERE
A. G. Semochkin *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 72-76 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 92-94 (For availability see N74-12335 03-20)

The effects of clouds on the probability distribution of the relative humidity in the free atmosphere are considered. It was demonstrated that with division of the initial sample into two parts with respect to number of clouds, the probability distribution of the relative humidity inside each sample can be approximated by beta distribution. Author

N74-12346 Joint Publications Research Service, Arlington, Va.
GUSTINESS OF THE WIND IN THE FREE ATMOSPHERE
G. P. Ilin and P. A. Rublev *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 77-79 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 95-96 (For availability see N74-12335 03-20)

The values of the gust factor are calculated by the data from a series of frequent radio wind soundings of the atmosphere to an altitude of H = 15 km. It is demonstrated that the gust factor has a minimum and a maximum at altitudes of about 5 km and 10.5 km, respectively. At the earth's surface the gust factor assumes a value close to 1.40. Author

N74-12347 Joint Publications Research Service, Arlington, Va.
CYCLICITY IN THE DEVELOPMENT OF THE ASIATIC ANTICYCLONE
A. I. Sorkina and A. P. Penkov *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 80-82 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 96-97 (For availability see N74-12335 03-20)

According to the data over many years (1891-1968) the autocorrelation function and the spectral density function of the mean January values of the atmospheric pressure in the center of the Asiatic anticyclone were calculated. It was discovered that in the interyear variations in the intensity of the anticyclone there is clear periodicity. Three oscillation periods are most clearly expressed: the quasibiannual, the three-four-year and the 22-year variations. Author

N74-12348 Joint Publications Research Service, Arlington, Va.
EFFECT OF HAIL CONTROL OPERATIONS ON THE AMOUNT OF PRECIPITATION
G. K. Sulakvelidze, A. I. Brodgantel, L. P. Klimovskaya, and M. Ye. Salukvadze *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 83-84 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 98 (For availability see N74-12335 03-20)

The effect of the crystallizing reagent introduced into the atmosphere in the vicinity of hail control operations on the precipitation conditions are considered. It is demonstrated that these operations lead to an increase in precipitation falling in the regions where hail control operations are carried out. Author

N74-12349 Joint Publications Research Service, Arlington, Va.
IS USE OF SOLAR ACTIVITY IN WEATHER FORECASTING REALISTIC AT THE PRESENT TIME?
V. A. Dzhordzhio and N. N. Romanov *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Jan. 1973 p 85-90 Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 99-103 (For availability see N74-12335 03-20)

The effect of solar activity on atmospheric circulation and weather is studied and the possibility of considering this activity in long range forecasting is considered. It is concluded that at the present time there are no real prerequisites for considering the solar activity in weather forecasting. Author

N74-12350 Joint Publications Research Service, Arlington, Va.
CONSTRUCTION OF AN OPERATIONAL SYSTEM FOR OPERATIVE DATA PROCESSING ON A COMPUTER **c08**
A. K. Artanova *In its* Meteorology and Hydrol., No. 8 (JPRS-60373) 26 Oct. 1973 p 91-102 refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1973 p 104-111 (For availability see N74-12335 03-20)

The basic characteristic features of the operational system satisfying the requirements of operative processing of meteorological data are discussed. As one of the special elements of this system, a study was made of a program limiting the solution of a number of operative analysis and forecasting problems with respect to the information reported to it. Author

N74-12351# Processes Research Inc., Cincinnati, Ohio.
AIR POLLUTION FROM FUEL COMBUSTION IN STATIONARY SOURCES Final Report
Oct. 1972 112 p refs
(Contract CPA-70-1)
(PB-222341/0; EPA-R2-73-241) Avail: NTIS CSCL 13B

The nature of the abatement strategies and costs of their implementation are estimated to achieve control to a predetermined quantity of emission on a national scale for the three major pollutants from fuel combustion: particulate, sulfur oxides, and nitrogen oxides. The situations for control of the 1980 emissions to the levels existing in 1970 and 1960 are presented. Abatement strategies to control the 1980 level of pollutant emissions to the alternative target levels, as obtained in 1960 and 1970 cases, were formulated and impressed on the 1980 situation. The 1980 emissions can be controlled to the targeted levels through implementation of control and fuels management practices. The estimated costs for achieving control are discussed including the effect on the supply and costs of fuel oil and coal. GRA

N74-12352# Research Triangle Inst., Durham, N.C.
GUIDELINES FOR DEVELOPMENT OF A QUALITY ASSURANCE PROGRAM. REFERENCE METHOD FOR MEASUREMENT OF PHOTOCHEMICAL OXIDENTS
Franklin Smith and A. Carl Nelson, Jr. Jun. 1973 112 p refs
(Contract EPA-68-02-0598)
(PB-222336/0; EPA-R4-73-028C) Avail: NTIS HC $7.75 CSCL 13B

Guidelines for the quality control of Federal reference method for photochemical oxidants are presented. These include: (1) good operating practices; (2) directions on how to assess data and qualify data; (3) directions on how to identify trouble and improve data quality; (4) directions to permit design of auditing activities; and (5) procedures which can be used to select action options and relate them to costs. The document is designed for use by operating personnel. GRA

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N74-12353 California Univ., Los Angeles.
APPLICATION OF EXTENDED KALMAN FILTERING TO A DYNAMIC LABORATORY CALIBRATION OF AN INERTIAL NAVIGATION SYSTEM Ph.D. Thesis
Frazier Jackson Hellings 1973 251 p
Avail: Univ. Microfilms Order No. 73-18631

A data reduction technique that obtains estimates of inertial sensor error model coefficients from a dynamic laboratory calibration of a typical inertial navigation system is discussed. The error model coefficients are those associated with gyros, accelerometers, and their misalignment errors that have been found by test and analysis to be the predominant sources of error affecting system accuracy. All the error terms considered are categorized as either fixed (independent of applied acceleration), first-order (proportional to the first power of acceleration), or higher-order terms, which are proportional to the square or cube of acceleration. In the case of the higher-order terms, the error model coefficients of inertial grade sensors are from one to four orders of magnitude smaller than the fixed and first-order terms. To obtain measurable quantities of these error sources requires the application of precise high-acceleration inputs from a laboratory test device. Dissert. Abstr.

N74-12354 California Univ., Los Angeles.
CONTROL OF AIR TRAFFIC BY AID OF SATELLITES Ph.D. Thesis
Charles Robert Johnson 1973 223 p
Avail: Univ. Microfilms Order No. 73-13147

The feasibility of a system of satellites for monitoring and controlling air-traffic on an intercontinental scale is analyzed. Satellites are essentially global in coverage and hence could establish the control of air-traffic on a real-time, intercontinental macro-scale basis. This multi-dimensional problem concerns the paths of many types of aircraft-departing, in normal flight, and in landing. The requirements for such monitoring and control obviously change with time, sometimes in ways predictable with confidence, sometimes in totally unforeseeable ways such as those forced by radical developments in technology. A unifying design approach is presented based upon an evolving-system program concept. The several satellite-system models that will need to be designed and flown for various stages of the overall program are described. Dissert. Abstr.

N74-12355*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
STRAPDOWN SYSTEM PERFORMANCE OPTIMIZATION TEST EVALUATIONS (SPOT), VOLUME 2 Final Report
Richard J. Blaha and Jerold P. Gilmore Feb. 1973 22 p
(Contract NAS9-6823; DSR Proj. 55-29435)
(NASA-CR-136083; R-743-Vol-2) Avail: NTIS HC $3.25 CSCL 17G

A three axis inertial system is packaged in an Apollo gimbal fixture for fine grain evaluation of strapdown system performance in dynamic environments. These evaluations have provided information to assess the effectiveness of real-time compensation techniques and to study system performance tradeoffs to factors such as quantization iteration rate. The strapdown performance and tradeoff studies conducted in this program are discussed. Author

N74-12356# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ATC SURVEILLANCE/COMMUNICATION ANALYSIS AND PLANNING Quarterly Technical Summary, 1 Jun. - 31 Aug. 1973
1 Sep. 1973 12 p
(Contracts DOT-FA72WAI-242; F19628-73-C-0002)
(FAA-RD-73-161) Avail: NTIS HC $3.00

A research project to improve air traffic control by the application of radar and electronics technology is discussed. The effectiveness of applying digital signal processing techniques to a search radar was investigated. Research projects were also conducted on the following: (1) airborne beacon interference locator, (2) transponder performance analyzer, and (3) electronically scanned antenna. Author

N74-12357*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
SPACE SHUTTLE GN AND C EQUATION DOCUMENT: ENTRY AND TRANSITION GUIDANCE
Fred J. Marcus Jun. 1973 40 p refs
(Contract NAS9-10268)
(NASA-CR-134148; Doc-17-Rev-3) Avail: NTIS HC $4.00 CSCL 17G

The entry-guidance routine presented is designed to take the orbiter vehicle from entry interface through the critical heating phase of entry down to the start of the approach phase. The material includes: (1) a functional flow diagram, (2) input and output variables, (3) a description of equations, and (4) detailed flow diagrams. D.L.G.

N74-12358*# Analytical Mechanics Associates, Inc., Jericho, N.Y.
NEW MECHANIZATION EQUATIONS FOR AIDED INERTIAL NAVIGATION SYSTEMS
Stanley F. Schmidt, William S. Bjorkman, and Bjorn Conrad Washington NASA Dec. 1973 59 p refs
(Contract NAS2-7329)
(NASA-CR-2352) Avail: NTIS HC $3.50 CSCL 17G

Inertial navigation equations are developed which use area navigation (RNAV) waypoints and runway references as coodinate centers. The formulation is designed for aided inertial navigation systems and gives a high numerical accuracy through all phases of flight. A new formulation of the error equations for inertial navigation systems is also presented. This new formulation reduces numerical calculations in the use of Kalman filters for aided inertial navigation systems. Author

N74-12359*# Research Triangle Inst., Durham, N.C.
INVESTIGATION INTO THE PROPAGATION OF OMEGA VERY LOW FREQUENCY SIGNALS AND TECHNIQUES FOR IMPROVEMENT OF NAVIGATION ACCURACY INCLUDING DIFFERENTIAL AND COMPOSITE OMEGA Final Report
Feb. 1973 147 p refs
(Contract NAS1-11298; RTI Proj. 43U-718-2)
(NASA-CR-132276) Avail: NTIS HC $9.50 CSCL 17G

An analysis of Very Low Frequency propagation in the atmosphere in the 10-14 kHz range leads to a discussion of some of the more significant causes of phase perturbation. The method of generating sky-wave corrections to predict the Omega phase is discussed. Composite Omega is considered as a means of lane identification and of reducing Omega navigation error. A simple technique for generating trapezoidal model (T-model) phase prediction is presented and compared with the Navy predictions and actual phase measurements. The T-model prediction analysis illustrates the ability to account for the major phase shift created by the diurnal effects on the lower ionosphere. An analysis of the Navy sky-wave correction table is used to provide information about spatial and temporal correlation of phase correction relative to the differential mode of operation. Author

N74-12360*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EN ROUTE POSITION AND TIME CONTROL OF AIRCRAFT USING KALMAN FILTERING OF RADIO AID DATA
Leonard A. McGee and Jay V. Christensen Washington Dec. 1973 103 p refs
(NASA-TN-D-7509) Avail: NTIS HC $4.25 CSCL 17G

Fixed-time-of-arrival (FTA) guidance and navigation is investigated as a possible technique capable of operation within much more stringent en route separation standards and offering significant advantages in safety, higher traffic densities, and improved scheduling reliability, both en route and in the terminal areas. This study investigated the application of FTA guidance previously used in spacecraft guidance. These FTA guidance techniques have been modified and are employed to compute the velocity corrections necessary to return an aircraft to a specified great-circle reference path in order to exercise en route time and position control throughout the entire flight. The necessary position and velocity estimates to accomplish this task are provided

by Kalman filtering of data from Loran-C, VORTAC/TACAN, Doppler radar, radio or barometric altitude,and altitude rate. The guidance and navigation system was evaluated using a digital simulation of the cruise phase of supersonic and subsonic flights between San Francisco and New York City, and between New York City and London. Author

N74-12361# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AIR TRAFFIC CONTROL/COLLISION AVOIDANCE SYSTEM INTERFACE SIMULATION, PHASE 2 Final Report, Jul. 1972 - Jun. 1973
G. Jolitz Nov. 1973 194 p refs
(FAA Proj. 052-241-050)
(FAA-NA-73-40; FAA-RD-73-140) Avail: NTIS HC $11.75

A second phase of dynamic simulation was conducted to further investigate the nature and extent of interaction between the air traffic control (ATC) system and an airborne collision avoidance system (CAS). Objectives of the simulation were threefold: (1) to investigate the impact on ATC when the preemptive CAS diverted an equipped aircraft into an encounter with an unequipped aircraft, (2) to investigate the effectiveness of a strategy for switching the CAS threat detection from full system mode to landing mode, and (3) to explore the three-way interface between a proposed general aviation version of the CAS, the commercial CAS and the ATC system. The simulated ATC environment was a high-density terminal area which provided for simultaneous approaches to parallel runways. The CAS threat detection logic was modeled after a design which was developed by a technical working group under the auspices of the Air Transport Association (ATA). The general aviation CAS was a scaled down but compatible version of the ATA system. Results of the simulation showed that the mode-switching strategy generally had the effect of reducing ATC/CAS interaction to a level where its effect was below the controllers' threshold of perception. Author

N74-12362# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary, 1 Jul. - 30 Sep. 1973
1 Oct. 1973 64 p refs
(Contracts DOT-FA72WAI-261; F19628-73-C-0002; FAA Proj. 034-241-012)
(FAA-RD-73-165) Avail: NTIS HC $5.25

The development of a discrete address beacon system for air traffic control applications is discussed. A description of operational problems peculiar to the discrete address beacon military interface is presented. Sensor design is reported under headings of antenna studies, reply processing, interrogation management, tracker studies, and use of radar data. The status of the experimental facility and the direction finding experiments are analyzed. Author

N74-12631 Federal Aviation Administration, Washington, D.C. Microwave Landing System Branch.
MLS PROGRAM: PHASE 2
Jack W. Edwards *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 9 p refs (For availability see N74-12580 03-34)
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22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N74-12363# Kanner (Leo) Associates, Redwood City, Calif
DIRECT MEASUREMENT OF VARIABLE AEROSOL CONCENTRATION IN A FAST REACTOR CHAMBER
S. Kitami, S. Uno, and J. Takada Dec. 1972 10 p refs Transl. into ENGLISH from Kuki Seijo. (Japan), v. 10, no. 2, 1972 p 34-36 Sponsored by EPA
(TR-302-73) Avail: NTIS HC $3.00

An automatic measurement of variation in aerosol concentration inside a container is reported in order to clarify the behavior of the nuclear fuel aerosol (sodium aerosol) inside the chamber at the time of an accident of a fast atomic reactor. An apparatus was constructed that is capable of (1) direct measurement of aerosol floating inside a sealed container; (2) measurement at temperatures higher than the normal room temperature; (3) treating aerosols composed of radioactive substances; and (4) treating aerosols of alkali substances. Experiments were carried out by using this apparatus and their results are summarized. Author

N74-12364*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF REACTOR COOLANT RADIOACTIVITY UPON CONFIGURATION FEASIBILITY FOR A NUCLEAR ELECTRIC PROPULSION VEHICLE
Leonard Soffer and Gilbert N. Wright Washington Dec. 1973 10 p refs
(NASA-TM-X-2949) Avail: NTIS HC $2.75 CSCL 21F

A preliminary shielding analysis was carried out for a conceptual nuclear electric propulsion vehicle designed to transport payloads from low earth orbit to synchronous orbit. The vehicle employed a thermionic nuclear reactor operating at 1575 kilowatts and generated 120 kilowatts of electricity for a round-trip mission time of 2000 hours. Propulsion was via axially directed ion engines employing 3300 pounds of mercury as a propellant. The vehicle configuration permitted a reactor shadow shield geometry using LiH and the mercury propellant for shielding. However, much of the radioactive NaK reactor coolant was unshielded and in close proximity to the power conditioning electronics. An estimate of the radioactivity of the NaK coolant was made and its unshielded dose rate to the power conditioning equipment calculated. It was found that the activated NaK contributed about three-fourths of the gamma dose constraint. The NaK dose was considered a sufficiently high fraction of the allowable gamma dose to necessitate modifications in configuration. Author

N74-12365# Joint Publications Research Service, Arlington, Va.
DISSOCIATING GASES AS COOLANTS AND WORKING SUBSTANCES AT ATOMIC POWER PLANTS
16 Nov. 1973 226 p refs Transl. into ENGLISH of the publ. "Dissotsiiruyushchiye Gazy kak Ieplonositeli i Rabochiye Tela Energeticheskikh Ustanovok" Minsk, 1973
(JPRS-60560) Avail: NTIS HC $13.50

A number of reports presented at the Third All-Union conference on Dissociating Gases as Coolants and Working Substances of Atomic Power Plants are given. Author

N74-12366# Atomics International, Canoga Park, Calif.
HASTELLOY X CLADDING MATERIAL EVALUATION
K. E. Moore, R. G. Brengle, and T. G. Parker, Jr. 15 Jun. 1973 57 p refs
(Contract AT(04-3)-701)
(AI-AEC-13083) Avail: NTIS HC $5.00

Hastelloy X is the reference fuel element cladding for the 5-kWe space power reactor. The effects of fuel element processing, and exposure to the reactor environment, were elevated by conducting mechanical property and corrosion tests on three heats of Hastelloy X in various heat-treat conditions. Mechanical properties of processed material are good agreement with literature values. Some ductility loss was observed in tensile tests. This is attributed to interstitial contamination resulting from the SCB ceramic hydrogen barrier coating process. Hastelloy X samples were exposed to flowing 1400 F NaK in a loop operated with a 90 F delta T to obtain accelerated corrosion effects. The exposed surfaces of these samples were affected to a depth of approximately 2 mils after 2000 h. The affected area had lost chromium, and contained intergranular microvoiding. Results of biaxial stress-rupture tests, performed in flowing NaK at 1300 F, indicate no significant effect properties. Author (NSA)

N74-12367# Atomics International, Canoga Park, Calif.
SNAP PROGRAMS BIBLIOGRAPHY
R. R. Eggleston, ed. 30 Jun. 1973 201 p refs
(Contract AT(04-3)-701)

(AI-AEC-13066) Avail: NTIS HC $12.00

An annotated bibliography of documents related to the SNAP reactor program is arranged according to subject matter. A listing of SNAP program progress reports arranged by project is also presented. A numerical listing of all previously unlisted SNAP reports is also included. NSA

N74-12368# Atomics International, Canoga Park, Calif.
ZIRCONIUM HYDRIDE FUEL ELEMENT PERFORMANCE CHARACTERISTICS
A. F. Lillie, D. T. McClelland, W. J. Roberts, and J. H. Walter 19 Jun. 1973 74 p refs
(Contract AT(04-3)-701)
(AI-AEC-13084) Avail: NTIS HC $5.75

Design of the U-ZrH fueled SNAP compact reactor requires: (1) prediction of the reactivity decrease over the core lifetime, associated with the loss of hydrogen moderator from the fuel elements, and (2) prediction of the anticipated fuel growth, for the particular reactor operating conditions, to assure integrity of the fuel element cladding. Extensive data were obtained during the course of the SNAP Reactor Development Program regarding the hydrogen retention characteristics of the ceramic lined fuel element, and regarding the fuel growth characteristics of the U-ZrH fuel. The ceramic liner was found to be a very effective and highly durable hydrogen barrier. The fuel growth, observed to consist of a rapid early life growth, followed by a much slower long term growth, was found to be temperature, flux, and fluence dependent. Author (NSA)

N74-12369# Atomics International, Canoga Park, Calif.
SUMMARY OF SNAP 8 DEVELOPMENTAL REACTOR (S8DR) OPERATIONS
L. D. Felten and H. D. May 22 Jun. 1973 93 p refs
(Contract AT(04-3)-701)
(AI-AEC-13071) Avail: NTIS HC $6.25

The SNAP 8 Developmental Reactor (S8DR) achieved criticality on June 22, 1968. Power operation was initiated in January of 1969, and continued throughout the year. Final shutdown was in December of 1969. The reactor logged 6688 hr at nominal 600 kW, and 429 hr at 1000 kW. Total energy release was 43,500 kWh thermal. Author (NSA)

N74-12370# Atomics International, Canoga Park, Calif.
FUEL ELEMENT AND CORE BUNDLE 5-kWe REACTOR THERMOELECTRIC SYSTEM
L. D. Felten and E. Moody 22 Jun. 1973 179 p refs
(Contract AT(04-3)-701)
(AI-AEC-13077) Avail: NTIS HC $11.00

The design of the core bundle for a 5-kW(e) zirconium hydride reactor is discussed. The design thermal power is 110 kW(t) at 1200 F outlet temperature for 5 years. Most of the thermal, hydraulic, and stress calculations have been completed for the core bundle. Operational stresses for the fuel elements show positive margins of safety. Author (NSA)

N74-12371# Brookhaven National Lab., Upton, N.Y.
EXPERIENCE WITH STRESS CORROSION CRACKING AND MATERIALS COMPATIBILITY AT THE HIGH FLUX BEAM REACTOR
R. W. Powell, J. G. Y. Chow, W. J. Brynda, M. H. Brooks, and J. R. Weeks 1973 16 p refs Presented at Symp. on Materials Performance in Operating Nucl. Systems, Ames, Iowa, 28 Aug. 1973 Sponsored by AEC
(BNL-17901; Conf-730801-4) Avail: NTIS HC $3.00

The primary system components of the high flux beam reactor are fabricated from two types of metals, aluminum 6061 and stainless steel Type 304. The aluminum reactor vessel and fuel element cladding establish the basis for the primary coolant system water and cover gas chemistry. An 18 in. dia stainless steel weld neck flange, which was a component of the primary coolant system piping, failed due to intergranular stress corrosion cracking. Stress analyses showed that hoop stresses due to high bolt tension were sufficient, when coupled with other circumstances, to be of significance. Detailed metallurgical analyses of some of the cracked pipe sections identified the cracks as intergranular cracks which orignated from the inside surface. Author (NSA)

N74-12372# Oak Ridge National Lab., Tenn.
IGNITION TOKAMAK
M. Huguet and P. H. Rebut [1973] 28 p Transl. into ENGLISH from the French Report
(ORNL-TR-2682) Avail: NTIS HC $3.50

A Tokamak designed for ignition purposes is discussed in some detail. The magnet coils are described in terms of their electrical and mechanical characteristics. The poloidal field and the required fluxes are discussed. Power supplies are discussed also. NSA

N74-12373# Commissariat a l'Energie Atomique, Paris (France).
RADIAL DISTRIBUTION OF THE CHARGE-EXCHANGE ATOM FLUX IN THE PLASMA OF THE TOKAMAK 4
M. P. Petrov 1973 10 p refs Transl. into FRENCH from Zh. Eksperim. i Teor. Fiz., Pis'ma v Redaktsiyu (Moscow), v. 17, no. 2, 1973 p 110-113 In FRENCH
(EUR-CEA-FC-689-TR) Avail: AEC Depository Libraries HC $3.00

The atom flux associated with the charge exchange of trapped ions was analyzed with respect to energy by inclining the axis of a 5-channel atom analyzer upward and downward in relation to the equatorial plane of the chamber. The radial distributions of the deuterium atom flux obtained in this way have symmetrical characteristics in a + or - 5-cm range about the small radius of the torus. The flux of the high-energy atoms decreases more rapidly at the periphery of the plasma with higher energies. The symmetry is violated when the axis of the analyzer is shifted from the equatorial plane by more than 10 cm, and the atom flux having E equal to or greater than 1.3 KeV begins to increase again. The deviation from axial symmetry of the atom flux distribution is due to the penetration of atoms at the plasma periphery. The symmetrical character of the atom flux distribution from the internal zone of a 10 cm diameter plasma indicates that the distribution has a Maxwellian nature and that the ion temperature distribution is symmetrical and axial. NSA

N74-12374# Atomics International, Canoga Park, Calif.
PROCESS DEVELOPMENT AND FABRICATION OF ZIRCONIUM HYDRIDE HASTELLOY X CLAD FUEL ELEMENTS
T. G. Parker, Jr. 30 Jun. 1973 44 p refs
(Contract AT(04-3)-701)
(AI-AEC-13082) Avail: NTIS HC $4.25

A summary is presented of the development work performed, and the processes established, for the fabrication of Hastelloy X-clad, U-ZrH x fuel elements. Processes described include: U-Zr alloy melting and extrusion, U-Zr hydriding, Gd_2O_3 vapor deposition of U-ZrH x fuel rods, machining helical fins in Hastelloy X cladding, Hastelloy X electron beam welding, ceramic coating of Hastelloy X, and final assembly operations. Process and test data on developmental fuel elements are presented, which demonstrate that the dimensional and performance test requirements of the 5-kW(e) zirconium hydride reactor could be met. Author (NSA)

N74-12375# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
QUANTITATIVE DETERMINATION OF THE STRUCTURE-PROPERTY RELATIONSHIPS IN NUCLEAR FUEL ELEMENT MATERIALS Quarterly Progress Report, 1 Jan. - 31 Mar. 1973
F. N. Rhines, R. T. DeHoff, and E. D. Whitney Jun. 1973 36 p refs
(Contract AT(40-1)-4212)
(ORO-4212-15) Avail: NTIS HC $4.00

A new, promising procedure for producing controlled microstructural gradients in porous bodies was tested. Gas permeability data for both UO_2 and nickel sintering appear to be related to microstructure by analogous but not identical equations. A re-analysis of all of permeability data was undertaken with an alternate description of the process. Expansion of the studies of creep in porous nickel to cover a range of particle sizes uncovered a synergistic effect between creep and densification. This behavior is deduced from the observation that the creep rate increases with decreasing particle size, at temperatures where no significant sintering is expected. A rationale explaining

the observed effect of compaction pressure upon tensile strength of sintered UO2 samples, tracing the effect to microstructural differences, was developed. The use of the vacuum hot press, with a suitable hydraulic attachment, for producing and measuring creep of porous UO2 samples at high temperatures, was shown to be feasible. Author (NSA)

N74-12376# Oak Ridge National Lab., Tenn.
MOLTEN-SALT REACTOR PROGRAM. PART 3: MATERIALS DEVELOPMENT Semiannual Progress Report, for period ending 31 Aug. 1972
H. E. McCoy Mar. 1973 204 p
(Contract W-7405-eng-26)
(ORNL-4832-Pt-3) Avail: NTIS

Work was done on (1) intergranular cracking of Hastelloy N in the MSRE fuel system and its control in future reactors, (2) development of a graphite with improved dimensional stability under radiation, (3) development of surface sealing methods for reducing the permeability of graphite to Xe-135, (4) modification of Hastelloy N for improved resistance to neutron irradiation, (5) evaluation of Hastelloy N for use in steam generators, (6) construction of a molybdenum system for use with bismuth and fluoride salts, and (7) evaluation of other structural materials for chemical processing plants. NASA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N74-12377# Maryland Univ., College Park. Center for Theoretical Physics.
IS THERE AN EXPERIMENTAL REALITY TO HIDDEN VARIABLES?
David S. Kershaw Oct. 1973 23 p refs
(Grant NSF GU-2061)
(TR-74-034) Avail: NTIS HC $3.25

The history of hidden variable theory is briefly reviewed. It is concluded that work in this field has been too theoretically oriented and that a more directly experimental approach is required. Basic criteria for a good hidden variable search experiment are developed. The significance of Bell's theorem on the inconsistency of hidden variable theories is discussed and used to develop these basic criteria. Three promising experiments are proposed and discussed. Author

N74-12378# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
SOUND SURVEY OF THE AIR BASE VALKENBURG
T. Houtgast and A. M. Mimpen 1973 19 p refs In DUTCH; ENGLISH summary
(IZF-1973-13) Avail: NTIS HC $3.00

The results of sound measurements at Valkenburg Air Base are reported. The measurements showed that for many sources in the workshops, the measured dB(A) level of the noise at the operator's ears exceeds the permitted 90 db(A). Adaptation of the work program is possible on the basis of an index assigned to every sound source for which the level exceeds 90 dB(A); with this index, the total noise load for an average workman can be calculated. The sound measurements around two types of airplanes stationned at the base, the Neptune and the Atlantic, result in a recommended distance of 200 m around the planes within which ear protectors have to be used by personnel to prevent hearing damage, regardless of the operation condition of the engines. Author

N74-12379# National Research Council of Canada, Ottawa (Ontario).
DISCUSSION OF AN EXPERIMENT TO INCREASE RESOLVING POWER
A. Lohmann and D. P. Paris 1973 14 p refs Transl. into ENGLISH from Optik (Stuttgart), v. 22, no. 3, 1965 p 226-234
(NRC-TT-1700) Avail: NTIS HC $3.00 CSCL 20F

Balancing of the deteriorating influence of the diffraction at the aperture by some kind of operation behind the aperture is investigated theoretically. Calculations demonstrate that an increase of resolution can be expected for a double slit if visual observation is used. However, if an objective method of observation is used, the resolution will be decreased by the operation. This example shows once again how careful the circumstances have to be defined in order to be able to make a percise statement about the resolution. Author

N74-12380# Joint Publications Research Service, Arlington, Va.
PRODUCTION OF HIGHLY TEXTURIZED PERMANENT MAGNETS FROM MAGNETICALLY ANISOTROPIC POWDERS
Ya. S. Shur, L. M. Magat, A. S. Yermolenko, N. A. Reshetnikov, V. S. Averkiyev, A. V. Deryagin, V. S. Boydenko, and Ye. V. Scherbakova 9 Nov. 1973 6 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Moscow), vol. 35, no. 2, 1973 p 422-424
(JPRS-60499) Avail: NTIS HC $3.00

A discussion is given on a method for the production of highly texturized permanent magnets from magnetically anisotropic powders. Author

N74-12381*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
ULTRASONIC SIGNAL ENHANCEMENT BY RESONATOR TECHNIQUES
Joseph S. Heyman Washington Dec. 1973 20 p refs
(NASA-TN-D-7417; L-9144) Avail: NTIS HC $2.75 CSCL 20A

Ultrasonic resonators increase experimental sensitivity to acoustic dispersion and changes in attenuation. Experimental sensitivity enhancement line shapes are presented which were obtained by modulating the acoustic properties of a CdS resonator with a light beam. Small changes in light level are made to produce almost pure absorptive or dispersive changes in the resonator signal. This effect is due to the coupling of the ultrasonic wave to the CdS conductivity which is proportional to incident light intensity. The resonator conductivity is adjusted in this manner to obtain both dispersive and absorptive sensitivity enhancement line shapes. The data presented verify previous thoretical calculations based on a propagating wave model. Author

N74-12382# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ENERGY OF MAGNETIC EXCITATIONS AND MAGNETIZATION IN COMPRESSIBLE FERROMAGNET
F. R. Vukajlovic and J. P. Vlahov 1973 15 p refs
(JINR-E4-7146) Avail: AEC Depository Libraries HC $3.00

An anharmonic ferromagnetic crystal under a constant pressure is considered. The pseudoharmonic approximation for the phonon system and the mean field approximation for the system are used. At low temperature an explicit expression for the temperature dependence of the lattice constant and its influence on the magnetic excitation spectrum and magnetization are obtained. Author (NSA)

N74-12383# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
HYDROSTATIC PRESSURE STUDIES OF MAGNETIC MODELS IN THE FAR INFRARED
K. C. Johnson and A. J. Sievers Apr. 1973 63 p refs
(Contract AT(11-1)-3151)
(COO-3151-17) Avail: NTIS HC $5.25

Messurement of the frequency shifts of far infrared active magnetic modes as a function of applied hydrostatic pressure permitted determination of the variation of the superexchange interaction with interionic spacing in MnO, MnF2, and MnF2: Fe 2(+). In the pure crystals the antiferromagnetic resonance was used as the probe of the exchange interaction, while in MnF2: Fe 2(+) observation of a localized magnetic impurity mode above the host spin wave band allowed the impurity-host exchange to be monitored. NSA

N74-12384# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.

INFRARED WINDOWS FOR USE AT LOW TEMPERATURES
W. J. Shotts and A. J. Sievers Apr. 1973 8 p refs
(Contract AT(11-1)-3151)
(COO-3151-22) Avail: NTIS HC $3.00

Vacuum tight mounts for polyethylene and germanium infrared windows operating at 77 and 1.2K, respectively, are described.
NSA

N74-12385# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
DESCRIPTION OF TIME VARIABLE SYSTEMS WITH ACOUSTIC FEEDBACK FOR STABILITY LIMIT DETERMINATION [BESCHREIBUNG ZEITVARIABLER SYSTEME ZUR ERMITTLUNG DER STABILITAETSGRENZE BEI AKUSTISCHER RUECKKOPPLUNG]
Friedrich Pesko 15 May 1972 12 p In GERMAN Sponsored by Deut. Forschungsgemeinschaft
(TB-152) Avail: NTIS HC $3.00

In view of the investigation of feedback systems with linear, time variable elements, a description is given of the transfer characteristics of linear, time variable systems. Periodically time variable systems are presented as a special case. The objective is to determine a stability limit in acoustic feedback circuits, and to test this by means of a sound field. The possibility for phase modulation using 90 deg filters is discussed. ESRO

N74-12661 Utah Univ., Salt Lake City. Dept. of Electrical Engineering.
LOSSES FROM MISALIGNED JOINTS IN SINGLE-MODE OPTICAL FIBERS
Robert J. Grow *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p refs (For availability see N74-12580 03-34)
Copyright.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N74-12386 Pittsburgh Univ., Pa.
RECOMBINATION OF ELECTRONS WITH POSITIVE IONS OF THE TYPE H3(PLUS), H5(PLUS), (H3O(PLUS))(H2O)n, AND HCO(PLUS) AT THERMAL ENERGIES Ph.D. Thesis
Ming-Taun Leu 1972 79 p
Avail: Univ. Microfilms Order No. 73-13190

Recombination coefficients of electrons with ions of the type H3(+), H5(+), (H3O(+), (H2O) n(n= 0,1,2,3,4,5,6), and HCO(+) were determined with a microwave afterglow/mass spectrometer apparatus at several temperatures. Afterglow measurements of electron density decays in gas mixtures are correlated with decays of mass-identified ion currents to the wall of the microwave cavity to assign unambiguously a measured recombination rate to a given ion. The implications of these results concerning ionization levels in the D region of earth's ionosphere, in the atmospheres of the outer planets, and in the interstellar medium are discussed. Dissert. Abstr.

N74-12387 Oklahoma State Univ., Stillwater.
PROTON MAGNETIC RELAXATION IN AQUEOUS COLLOIDAL SILICA Ph.D. Thesis
Richard Raymond Slater, Jr. 1972 235 p
Avail: Univ. microfilms Order No. 73-15240

A low field NMR instrument of the type that utilizes free precession in the earth's magnetic field was developed and constructed. It was used to observe the field-dependence of the proton T sub 1 in aqueous colloidal silica in the interval 0.56 to 14 kG. The proton T sub 1 was also measured as a function of temperature, of colloid concentration, of pH, of ionic strength, of deuteron concentration in the bulk liquid, and of the physical state of colloid. ESR and direct chemical analyses were also employed. It was found that iron (III), incorporated into the SiO2 lattice, accounts for the field-dependence observed, and that the scalar interaction is dominant. The pH dependence, gel behavior and anomalous temperature-dependence can all be interpreted in terms of simple chemical kinetics, provided that the lattice iron (III) impurity has a sufficiently long electron relaxation time. Dissert. Abstr.

N74-12388 University of Southern Calif., Los Angeles.
RESONANCE FLUORESCENCE FROM BOUND EXCITONS IN GaP, AND PHOTODISSOCIATION OF THE EXCITONS BY FAR INFRARED RADIATION Ph.D. Thesis
Martin Adolph Gundersen 1973 80 p
Avail: Univ. Microfilms Order No. 73-14408

Some effects of photodissociation of excitons bound to impurities in GaP, by far infrared radiation are presented. Photodissociation is typically seen as a quenching of the fluoresencence from the centers. The quenching depends upon the infrared wavelength and the binding energy of the exciton. Under certain circumstances an increase in the absolute intensity of fluorescence of the exciton bound to N in GaP has been observed. Evidence is presented which indicates that in this circumstance excitons are being liberated from a more deeply binding impurity and are being trapped at nitrogen sites. An attempt to observe phonon breakdown is discussed. The observation of the phonon sidebands of a bound exciton by resonant excitation of the bound exciton is described.
Dissert. Abstr.

N74-12389 Georgia Inst. of Tech., Atlanta.
MEASUREMENT OF STEADY-STATE, SPACE DEPENDENT THERMAL NEUTRON SPECTRAL IN BERYLLIUM Ph.D. Thesis
James Alan Lake 1972 297 p
Avail: Univ. Microfilms Order No. 73-14080

A direct experimental verification was made of the disappearance of the discrete fundamental mode decay and the concurrent existence of the continuum range of eigenvalues and eigenfunctions in the diffusion length problem in small, steady state crystalline systems with strong transverse leakage effects. Space dependent angular thermal neutron spectra were measured along the longitudinal axes of 25.4 x 25.4 x 50.8 and 35.6 x 35.6 x 50.8 cm beryllium assemblies by the neutron chopper, time-of-flight technique. The spectra for neutrons moving away from the source were characterized by a progressive build-up of cold neutrons, below the Bragg cut-off, with increasing distance from the source plane; the relative rate of cold neutron build-up increasing with increasing transverse buckling. In both assemblies, the angular spectrum was found to be strongly space dependent and in neither was there andy apparent tendency toward an equilibrium or asymptotic distribution out to distances in excess of 40 cm from the source plane. Dissert. Abstr.

N74-12390*# Brown Univ., Providence, R.I.
COMPOSITION DEPENDENCE OF ION TRANSPORT COEFFICIENTS IN GAS MIXTURES
J. H. Whealton, E. A. Mason, and R. E. Robson (Alberta Univ., Edmonton) [1973] 15 p refs Sponsored in part by NRC of Canada
(Grant NGL-40-002-059)
(NASA-CR-136228) Avail: NTIS HC $3.00 CSCL 20I

A simple momentum-transfer theory for the composition dependence of ion mobilities and diffusion coefficients in gas mixtures at arbitrary field strengths is corrected, extended, and compared with a similar theory based on momentum and energy transfer, and with results based on direct solution of the Boltzmann equation by Kihara's method. Final equations are recommended for predicting composition dependences, given only results on ion mobilities and diffusion coefficients in the pure component gases. Author

N74-12391# Physics Lab. RVO-TNO, The Hague (Netherlands).
THEORY OF ELECTRON MULTIPLICATION
T. F. Risselada Aug. 1973 21 p refs In DUTCH; ENGLISH summary
(PHL-1973-32) Avail: NTIS HC $3.25

In a literature study of electron multiplication in multipliers, some theoretical aspects of signal and noise of stage image

intensifiers are discussed. The pulse height distribution, the signal to noise ratio, and the shape of the pulses are discussed.
Author

N74-12392# Illinois Univ., Urbana. Dept. of Physics.
PHYSICAL TRAJECTORIES IN AN INCLUSIVE DUAL RESONANCE MODEL
J. Randa Nov. 1973 48 p refs
(Grant NSF GP-25303)
(ILL-(TH)-73-16) Avail: NTIS HC $4.50

The dual resonance model in inclusive vector meson production is extended to include both abnormally coupled trajectories and trajectories with positive intercept. Differential cross sections and density matrix elements are obtained and compared to those of previous calculation. Ths single-particle spectrum for spinless mesons is also obtained and compared to earlier results.
Author

N74-12393*# Avco Corp., Wilmington, Mass. Systems Div.
STUDY OF PHOTOEMISSION AND WORK FUNCTION OF LARGE SURFACE AREAS, PHASE 3, PHASE 4 Final Report
1973 69 p refs
(Contract NAS5-11138)
(NASA-CR-132877; AVSD-0295-73-PR) Avail: NTIS HC $5.50 CSCL 20H

The photoemission of materials which might be used in probe measurements of the exo-atmospheric electric field is considered by evaluating the wavelength dependence of their photoelectric yield for eleven elements over the range 800 to 3200 A. Yield data for zinc, copper beryllium, platinum, cadmium, graphite, carbon, gold, silver, tantalum, and tungsten show that copper-beryllium is a preferred material. Silver has one of the highest photoemissions when exposed to solar radiation.
G.G.

N74-12394# Kanner (Leo) Associates, Redwood City, Calif.
BEHAVIOR OF AEROSOL PARTICLES IN CLOSED VESSELS
Kanji Takahashi Jan. 1973 20 p refs Transl. into ENGLISH from Kuki Seijo (Japan), v. 10, no. 2, Jun. 1972 p 27-33
Sponsored by Environ. Protection Agency
(TR-307-73; APTIC-43775) Avail: NTIS HC $3.00

The behavior of aerosol particles in closed vessels is analyzed to determine the conditions to be expected in a nuclear reactor during a reactor accident. The basic assumption is that the initial state of the aerosols is maintained uniform in the container with respect to temperature and particle concentration. There is no source of generation of aerosol particles and the air is in a dry state. Mathematical models are developed to describe the conditions for various flow characteristics.
Author

N74-12395# National Bureau of Standards, Washington, D.C.
GRAPHICAL RECOUPLING OF ANGULAR MOMENTA
D. R. Lehman (George Washington Univ., Washington, D. C.) and J. S. OConnell Oct. 1973 18 p refs
(NBS-Monograph-136) Avail: HC $0.50 as C13.44:136

A diagrammatic method for solving angular momentum recoupling problems is presented. It is shown that a few graphical elements with a set of rules for their use lead to the solution of many types of recoupling problems in an intuitive and systematic way. Several examples are given together with exercises on the use of the method.
Author

N74-12396# Joint Publications Research Service, Arlington, Va.
GYROMAGNETIC COMPRESSION OF POWERFUL RELATIVISTIC DENSE TUBULAR ELECTRON FLUXES
M. L. Levin, A. L. Mints, Ye. D. Naumenko, and T. N. Filimonova 14 Nov. 1973 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 211, no. 5, 1973 p 1085-1088
(JPRS-60529) Avail: NTIS HC $3.00

The method of compressing segments of the tubular electron flux by gyromagnetic ring generator cathodes is reported.
G.G.

N74-12397# Stanford Univ., Calif. Dept. of Physics.
NUCLEAR STRUCTURE INVESTIGATIONS WITH AN FN TANDEM ACCELERATOR Progress Report, 1 Mar. 1972 - 28 Feb. 1973
Stanley S. Hanna and Walter E. Meyerhof 1 Sep. 1973 136 p refs
(Grant NSF GP-8163-A4)
Avail: NTIS HC $11.00

Polarized and unpolarized reactions have been used to study light nuclei. The cluster structure of the giant resonance has been investigated through the study of capture reactions with complex nuclei. Analog states have been studied by means of unpolarized and polarized reactions and a search for double analog states has been started. Heavy ion induced reaction studies have begun in order to get an overview of the reaction mechanisms. Magnetic moments of several nuclei have been determined with a variety of methods. Proton and alpha scattering from polarized Ho-165 has been accomplished and the cross section has been analyzed in terms of a refined optical model. K X-ray emission during the collision of two Br-35 atoms has been detected, giving X-rays up to the united atom limit for Z = 70. K vacancy formation in the bombardment of a variety of targets with Z = 13 to 92 by iodine beams has been investigated, and a variety of heavy ion beams up to U have been produced.
Author

N74-12398# Bergen Univ. (Norway). Dept. of Physics.
PITCH ANGLE DISTRIBUTIONS IN AND NEAR THE LOSS CONE OF (100 TO 350) keV PROTONS
R. Amundsen Jan. 1973 28 p refs
(NP-19814; TR-52) Avail: NTIS Hc $3.50

The pitch angle distribution in and near the loss cone, of approximately (100 to 200) and approximately (200 to 350) keV protons observed by the ESRO 1B satellite during the period October 7-15, 1969 are presented. The data include periods of relative quiet as well as more disturbed geomagnetic conditions. Spatial characteristics and dynamics of the protons, both on the night and day side of the earth are described. The actual pitch angle distribution is interpreted as produced by wave particle interactions, and the diffusion coefficient and lifetime against pitch angle scattering have been estimated from existing theories. During slightly disturbed conditions, the observations suggest an average random walk in pitch angle made by a particle during a crossing of the diffusion region. The lifetime against pitch angle scattering into the loss cone is found to be somewhat less than the charge-exchange lifetime for these (100 to 350) keV protons.
Author (NSA)

N74-12399# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
HIGH ENERGY NUCLEAR INTERACTIONS WITH MATTER AND NUCLEAR PROCESSES IN NATURE Annual Report, 1 Jul. 1972 - 30 Jun. 1973
O. A. Schaeffer 1973 14 p refs
(Contract AT(11-1)-3080)
(COO-3080-2) Avail: NTIS HC $3.00

Proton cross sections for the production of stable rare gases in uranium and vanadium were extended to higher energies. The Ar-39 and Cl-36 content of the Benthullen meteorite was measured in order to determine its terrestrial age. Experimental procedure, of the activity extraction from the FeNi phase and the stone phase is described. The preliminary result of 75 years is much younger than expected. A low level proportional counting system for Ar-37,39 and Cl-36 was set up. Background counting rates of 3 to 10 counts per day could be achieved. The activities are released from meteorites and targets by either vacuum melting or dissolving in new designed vacuum apparatus.
Author (NSA)

N74-12400# Jyvaskyla Univ. (Finland). Dept. of Physics.
HELIUM-JET TRANSPORTATION OF RECOIL ATOMS INTO A LIQUID PHASE
P. Puumalainen, J. Aysto, and K. Valli Mar. 1973 12 p refs
(NP-19805) Avail: AEC Depository Libraries HC $3.00

A rapid, inexpensive method was developed for transportation of recoiling short lived radioactive nuclides from a target chamber over distances of several meters into a liquid phase. This allows rapid radiochemical separation of different elements. The carrier loaded helium jet transport technique is employed without a pumping systems. The method would appear to be applicable to most chemical elements. The transport efficiency is higher

than 50% and the transport time can be made much shorter than 1 s. Radiochemical separation times of a few s were achieved. Author (NSA)

N74-12401# Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany).
INVESTIGATIONS ON NEUTRON MEASURING TECHNIQUES USING TRACK DETECTORS [UNTERSUCHUNGEN ZUR NEUTRONENMESSTECHNIK MITTELS KERNSPURDETEKTOREN]
W. Abmayr, G. Burger, G. Gruenauer, and H. G. Paretzke Bonn Bundeswehramt 1973 34 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-73-19) Avail: NTIS HC $3.75; Bundeswehramt 20 DM

A non-photographic method using platic detectors was utilized for neutron track detection. A model of track etching was developed to deduct the characteristic particle parameters from the measurable track diameters, via the evaluation of the preferential track-etching rate. Thorium and uranium foil set-ups were used to test fission foil conversion techniques. The applicability of the method for spectrometric purposes was treated theoretically. For automatic counting of low etch-pit densities, a spark counter was developed; for higher etch-pit densities, optical scanning devices with on-line computer analysis were tested and used. Author (ESRO)

N74-12402# Nuklear-Chemie und -Metallurgie, G.m.b.H., Wolfgang Bei Hanau (West Germany).
TRITIUM TARGETS OF LONG LIFETIME FOR NEUTRON ACTIVATORS [TRITIUMTARGETS GROSSER LEBENSDAUER FUER NEUTRONENBESCHLEUNIGER]
H. Fabian Bonn Bundeswehramt 1973 47 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-73-22) Avail: NTIS HC $4.50; Bundeswehramt 20 DM

Tritium-containing targets supply neutrons with an energy of 14 MeV bombarded with deuterons. These targets are used in research and development. For practical use the neutron yield and the lifetime of the targets are very important. The aim of this program was to improve the quality of solid and gas targets. For solid targets a multilayer target with a tritium reservoir layer and a target with a long time tritium supply were developed. An extension of the life time up to 5 times could be reached as compared with standard targets. Before practical use several remaining problems have to be solved. For gas targets window foils for relatively high pressure and thermal load were developed. A window for a pressure of 10 atm and a thermal load of 1 KW was achieved. Author (ESRO)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N74-12403 Vanderbilt Univ., Nashville, Tenn.
CURRENT SHEET STRUCTURE IN A THETA PINCH Ph.D. Thesis
Garry Robert Kenny 1972 128 p
Avail: Univ. Microfilms Order No. 73-14517

The current sheet structure and plasma state inside a theta pinch device has been studied using electric and magnetic field probes. One objective of the experiment was to demonstrate that the probe data is sufficient to allow determination of nearly all important plasma parameters obtainable by the more laborious and exacting spectroscopic, scattering, and interferometer diagnostic techniques. Contamination of the plasma by material ablated from the probes was avoided by operating the device at low energy (1000 J). Spectroscopic measurements showed the helium plasma to be quite free of impurities and substantiated the few eV electron temperature calculated from the probe data. The effects of plasma-probe interactions were noticeable in the data, but in general the uncertainties of the results were no greater than those associated with other diagnostic methods. Dissert. Abstr.

N74-12404 Mississippi State Univ., State College.
LASER ABSORPTION MEASUREMENTS IN A SUPERSONIC ARGON PLASMA Ph.D. Thesis
Dennis Ray Smith 1973 166 p
Avail: Univ. Microfilms Order No. 73-13621

An investigation was conducted to determine if excitation of the electronic states involved in there dominant argon ion laser transitions could be achieved in a supersonic flow in which the excitation region was a finite distance upstream of the supersonic expansion. An arc heated argon plasma tunnel was designed and constructed. For excitation of the argon gas, a magnetoplasmadynamic arc was used. To achieve supersonic flow, a two dimensional uncooled slit orifice nozzle was used. The existence of the argon ion electronic states was investigated by probing transversely across the supersonic flow with a diagnostic laser beam. The relative magnitude of the densities of the argon ionic states was indicated by the absorption of the low power probe beam by the plasma stream. Dissert. Abstr.

N74-12405 Stanford Univ., Calif.
NONLINEAR WAVE INTERACTIONS ON A PLASMA COLUMN Ph.D. Thesis
Jean-Marc Larsen 1973 164 p
Avail: Univ. Microfilms Order No. 73-14923

A theoretical and experimental study was conducted of two cases of nonlinear wave interaction in a plasma column. The frequencies of the waves are of the order of magnitude of the electron plasma frequency. Ion motions are neglected. The nonlinear coupling of slow waves on a plasma column is studied by means of cold plasma theory. The quasistatic approximation is used to simplify the analysis. Nonlinear scattering from a plasma column in an electromagnetic field having its magnetic field parallel to the axis of the column was investigated. Observations of nonlinear scattering are presented and the effect of the earth's magnetic field and of discharge symmetry on the radiation pattern are discussed. Dissert. Abstr.

N74-12406# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DIFFUSION OF PLASMA CONFINED IN STELLARATOR WITH EPSILON SUB t < EPSILON SUB h
Kenro Miyamoto Sep. 1973 13 p refs
(IPPJ-177) Avail: NTIS HC $3.00

Diffusions of plasma confined in a stellarator are discussed when the field modulation and epsilon sub t of toroidal curvature is larger than the modulation and epsilon sub b of helical field, which is usal case of the toroidal stellarator with medium aspect ratio. The dependence of the diffusion coefficient on the collision frequency in the very low frequency region is different in the cases of epsilon sub t greater than epsilon sub b and epsilon sub t less than epsilon sub b. Author

N74-12407# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A THEORETICAL PREDICTION OF THE OBSERVED PLASMA HEATING IN THE COMPRESSION EXPERIMENT OF ITO'S GROUP AT OSAKA UNIVERSITY
Igor Alexeff Aug. 1973 12 p
(IPPJ-174) Avail: NTIS HC $3.00

A simple, model-independent description of the compression experiment of Ito's group is discussed. This model predicts the observed plasma heating and final plasma beta to within a factor of two. Author

N74-12408# Nagoya Univ. (Japan). Inst. of Plasma Physics.
AMPLIFICATION OF SOUND WAVES IN PARTIALLY IONIZED GASES
Masaaki Hasegawa Sep. 1973 24 p refs
(IPPJ-173) Avail: NTIS HC $3.25

The behavior of the sound wave in a positive column of grow discharge was experimentally investigated. When the sound wave propagates in the positive column, the amplification of the sound wave is observed. The growth rate of the amplitude and the phase velocity are increased with the discharge current. When the discharge tube is cooled down to the liquid nitrogen temperature, the growth rate increases three times as much as that in the room temperature. The experimental results suggest that the sound wave is unstable in the grow discharge. Author

N74-12409# Nagoya Univ. (Japan). Inst. of Plasma Physics.
OBSERVATION OF ION ACOUSTIC WAVE BY MICROWAVE SCATTERING METHOD
Atsushi Mase, Takumi Yamamoto, and Takashige Tsukishima Aug. 1973 29 p refs
(IPPJ-172) Avail: NTIS HC $3.50

An ion acoustic wave in a current carrying plasma is studied by the microwave scattering method. A technique of incoherent scattering of electromagnetic wave of f sub = 35 GHz by ion acoustic waves of f = 20 to 70 kHz is described. A dispersion relation and the intensity distribution in k-space of the ion acoustic wave is determined from the angular distribution of the scattered wave. A spatial evolution of the ion acoustic waves along the tube axis is also observed. The observed spatial growth rates are compared with calculated values which take account of both linear and nonlinear growth rates. A good agreement is obtained when the nonlinear effect is assumed as mainly due to the ion trapping. Author

N74-12410# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A METHOD TO MAKE THE RF PLUGGING EFFICIENT IN THE POINT CUSP
Tadatsugu Hatori Aug. 1973 19 p refs
(IPPJ-171) Avail: NTIS HC $3.00

A method is given to reduce the plasma radius in the point cusp to the order of the ion Larmor radius making the RF plugging efficient there. It is shown that it is possible to make the width (radius) of the plasma in the line (point) cusp to the order of the ion thermal Larmor radius when the plasma is injected from one of the point cusps. To do this, it is indispensable to prevent electrons from flowing back through the line cusp. The thin (slender) plasma is convenient for the RF plugging method. It is possible to improve the containment of the axially symmetric system, by utilizing cusp geometry along with the RF plugging method. Author

N74-12411# Nagoya Univ. (Japan). Inst. of Plasma Physics.
FINITE AMPLITUDE ION ACOUSTIC WAVES IN A PLASMON GAS
Junichi Sakai, Junkichi Satsuma (Kyoto Univ.), and Nobuo Yajima (Kyushu Univ.) Aug. 1973 28 p refs
(IPPJ-170) Avail: NTIS HC $3.50

The propagation of ion acoustic waves interacting with plasmon gas is investigated by eliminating the fast varying part from the system through an adequate averaging procedure. The decay interaction plays an important role in this process and leads to the damping or growth of the ion acoustic wave, depending on the shape of the plasmon energy spectrum. It is found that the finite amplitude ion acoustic wave in plasmon gas is subject to the KDV equation modified by two additional terms which represent the change of the phase velocity and the damping or growth of the amplitude. The comparison of the obtained decay rate with that of the electron Landau damping is also made. Author

N74-12412# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NONADIABATIC MOTION OF CHARGED PARTICLE IN AN INHOMOGENEOUS MAGNETIC FIELD
G. Horikoshi, H. Toyama, and T. Kuroda Jul. 1973 27 p refs
(IPPJ-169) Avail: NTIS HC $3.50

A new analytic expression is obtained in a differential form for nonadiabatic change of magnetic momentum of a charged particle in an inhomogeneous magnetic field. The expression gives a picture easier to be understood than the past. The results agree well with previous numerical calculations. Author

N74-12413# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTRON ORBIT IN ERA (ELECTRON RING ACCELERATOR) WITH AN ELECTROSTATIC TYPE INFLECTOR SYSTEM
H. Toyama and H. Ishizuka Jul. 1973 15 p refs
(IPPJ-168) Avail: NTIS HC $3.00

Electron orbits in ERA with an inflector system are calculated. The operational condition for effective capture of the electron beam is represented. Author

N74-12414# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PARAMAGNETIC CONFIGURATION WITH ABSOLUTE MINIMUM-B PROPERTY
K. Ikuta Jul. 1973 12 p refs
(IPPJ-167) Avail: NTIS HC $3.00

The equilibrium configuration is calculated including the beam-plasma interaction. This type of equilibrium allows the paramagnetic configuration with absolute minimum-B property. Configuration with both high shear and absolute minimum-B is possible without external guide field. Author

N74-12415# Joint Publications Research Service, Arlington, Va.
COMPLEX EFFECTS OF RADIATION FOR MOVING SOURCES IN PLASMA
Yu. M. Sorokin 14 Nov. 1973 15 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Radiofiz. (Gorki), v. 16, no. 3, Mar. 1973 p 342-350
(JPRS-60533) Avail: NTIS HC $3.00

A discussion is presented on an investigation of angular and frequency spectra of radiation sources uniformly moving in isotropic plasmas. Author

N74-12416# Joint Publications Research Service, Arlington, Va.
STUDIES OF LIQUID-METAL FLOWS IN MAGNETOHYDRODYNAMIC SYSTEMS
27 Nov. 1973 72 p refs Transl. into ENGLISH of papers presented at IAEA Symp. on Elec. from Magnetohydrodyn., Salzburg, 1966, and Warsaw, 1968
(JPRS-60634) Avail: NTIS HC $5.75

Articles and abstracts are presented on liquid-metal flows in magnetohydrodynamic systems. Author

N74-12417# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
NON-LINEAR WAVE PROPAGATION FOR A SLIGHTLY INHOMOGENEOUS PLASMA
E. S. Weibel Oct. 1973 12 p refs
(LRP-69/73) Avail: NTIS HC $3.00

A medium which may be slightly inhomogenous in space and time is characterized by its current response. A system of equations that describes the linear and nonlinear coupling of WKB modes is devided. Author

N74-12418# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
COLLISIONLESS ION ACOUSTIC SHOCK WAVES IN A TWO COMPONENT PLASMA
M. Q. Tran, M. Bitter, and P. J. Hirt Oct. 1973 15 p refs
(LRP-68/73) Avail: NTIS HC $3.00

The structure of stationary ion acoustic shocks in a two component plasma was studied. Unlike to the situation in a one component plasma, there exists an oscillatory structure of the trailing edge even for zero ion temperature due to the reflection of light ions. The wavelength and amplitude of these oscillations were calculated in dependence of the Mach number and the concentration of light ions. Author

N74-12419# California Univ., La Jolla.
THEORETICAL PLASMA PHYSICS RESEARCH Progress Report, 1972 - 1973
W. B. Thompson 27 Jun. 1973 619 p refs
(Contract AT(04-3)-34)
(UCSD-34-P-85-16) Avail: NTIS HC $33.00

This report includes new results on neoclassical and two-dimensional diffusion, on beam-induced instabilities, and on plasma wave resonance of interest in RF heating, as well as studies in kinetic theory and the interaction of plasma and radiation. Author (NSA)

N74-12420# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ENERGY PRINCIPLE FOR PLASMA STABILITY AGAINST LOW-FREQUENCY ELECTROSTATIC MOTIONS
J. Andreoletti [1973] 1 p refs Presented at Intern. Conf. on Waves and Instabilities in Plasmas, Innsbruck, 2-6 Apr. 1973
(CEA-Conf-2316; Conf-730446-1) Avail: NTIS HC $3.00

Starting from the biadiabatic motion of a charged particle in a strong magnetic field, the equations governing the slow

electrostatic motions of a collisionless plasma are obtained. The second order variation of the total energy is calculated, and then verified that it is in fact conserved by small motions. By expanding the distribution function for high phase velocities with respect to drift velocities, a Lagrangian formalism is established and it is shown that in this domain the variational condition derived from the energy is necessary and sufficient for stability. This result is derived for arbitrary magnetic fields and distribution functions and it accounts for the slow interchange motions as well as the so called trapped particle motions. The application to axisymmetric cases with locally Maxwellian distributions reproduces already known expressions. Author (NSA)

N74-12421# Dartmouth Coll., Hanover, N.H.
NONLINEAR CONTROL OF TURBULENCE AND VELOCITY SPACE DIFFUSION IN BEAM-PLASMA SYSTEMS Progress Report, 14 Sep. 1972 - 14 Jun. 1973
J. E. Walsh, J. R. Conrad, C. J. Diaz, K. B. Freese, G. L. Hoffman, and R. W. Layman 14 Jun. 1973 45 p refs
(Contract AT(11-1)-3632)
(COO-3632-11) Avail: NTIS HC $4.25

Measurements of electron heating in a moderate-energy, low density, beam - plasma system are presented. Stability of the system is discussed and relationships between the degree of initial instability and beam energy transfer to the target plasma are established. The average electron energy viewed as a function of increasing initial destabilization is found to pass through three stages. In the first, the spectrum of the excitations is narrow, the average energy is dominated by the beam, and there is little energy transfer to the plasma. In the second, the spectral distribution is broader, the average particle energy decreases, and more energy is transferred to the wave spectrum. In the third stage, the spectrum extends from cutoff to an appreciable fraction of the plasma frequency. The average electron energy increases as the beam energy transferred to the spectrum is redistributed among the particles. In this latter stage, a high-energy tail appears on the distribution. A correlation between the appearance of this tail and the excitation of electron plasma waves near the lower hybrid cutoff is established. Author (NSA)

N74-12422# Paris Univ., Orsay (France).
INSTABILITY OF AN IONIZATION WAVE IN A PLASMA EXCITED AT ONE OF ITS hf RESONANCES Ph.D. Thesis
Annie Peyre 1972 205 p refs In FRENCH
(FRNC-TH-369) Avail: AEC Depository Libraries HC $12.25

Ionization waves are often self-excited at low pressures (in excess of 20 mtorr) with small currents. A means was discovered for rendering them unstable in low-pressure arcs (a few mtorr) in which their existence is less apparent. It was experimentally and theoretically demonstrated that these instabilities can occur as a result of a low-power hf field applied at one of the hf radial resonances of the plasma column. Favorable conditions are always required: the operating point for the discharge should lie on the positive part of the absorbed hf power curve; this power must be greater than a certain critical value (200 to 300 mW). The agreement between the theoretical and experimental results (dispersion equation, wavelength of the maximum excited signal) is satisfactory in spite of the imperfections in the theoretical model chosen. NSA

N74-12423# Rouen Univ. (France).
IONIZATION KINETICS OF AN ARGON PLASMA CREATED BY A SHOCK WAVE Ph.D. Thesis
G. Larcher 1972 184 p refs In FRENCH
(FRNC-TH-365) Avail: AES Depository Libraries HC $11.25

Some preliminary calculations concerning the thermodynamic parameters of the gas when subjected to the shock wave are presented. A description is given of the shock tube and the optical methods used in the measurements (strioscopy and spectrophotometry) for determining the velocity of the shock wave, the observation time, the relaxation time, and the electron temperature and density at equilibrium. The results obtained in measurements of the radiation energy losses in the cooling zone were studied. The ionization kinetics near to equilibrium obtained by measuring the intensity of the continuously emitted background were compared with the calculated behavior of the electron density, the existence of ionization processes due to electron-atom collisions in the plasma out of thermodynamic equilibrium being admitted. The method used to determine the electron density near to the shock front is outlined. Author (NSA)

N74-12424# Rouen Univ. (France).
STUDY OF RADIATIONS IN PLASMAS Ph.D. Thesis
G. Piar 1972 223 p refs In FRENCH
(FRNC-TH-364) Avail: AEC Depository Libraries HC $13.25

A spectroscopic study was initially carried out on the limiting layers developing in the vicinity of a plane metallic wall situated in an argon plasma flow. This investigation was carried out in a specially constructed plasma wind tunnel. In this way, the electron temperature and density were determined from the intensities of the emission lines at atmospheric pressure and at low pressure. It was shown that the ion-electron recombination rate was principally a function of the depopulation of the resonance levels. An attempt was made to interpret the electron temperature results in terms of the emission of Auger electrons with high energies. The high electron density observed near to the wall agrees with collisionless sheath theories. The second part of this thesis is devoted to a laser-matter (deuterium) interaction experiment. This experiment enabled the existence of nuclear fusion reactions associated with the creation of the plasma to be established. NSA

N74-12425# Dartmouth Coll., Hanover, N.H.
SCATTERING IN A STABLE BEAM-PLASMA SYSTEM
C. J. Diaz, J. R. Conrad, and J. E. Walsh 1973 23 p refs
(Contract AT(11-1)-3632)
(COO-3632-10) Avail: NTIS HC $3.25

A Fokker-Planck equation is used to describe the random walk of the particles in stable electron-beam-driven fluctuations. The resulting kinetic equation is a bounded version of the Balescu-Lenard equation. The ion velocity distribution relaxation rates calculated on the basis of this equation exhibit a resonant structure for velocities near synchronism with the phase velocities of the modes predicted by the dispersion relation. Author (NSA)

N74-12426# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
LOCALIZED CRITERIA OF STABILITY IN MHD
C. Mercier 1972 19 p refs Presented at Intern. Conf. on Waves and Instabilities in Plasmas, Innsbruck, 2-6 Apr. 1973
(CEA-Conf-2317; Conf-730446-2) Avail: AEC Depository Libraries HC $3.00

The study of MHD stability in plasmas with scalar pressure and infinite conductivity is carried out on the basis of the energy principle. In the case of toroidal plasmas, in spite of numerous studies, the region of complete stability is not yet perfectly known. Perturbations localized near a magnetic surface are discussed. One can distinguish between two classes of such perturbations: one of these classes leads to the usual localized criterion which has been extensively applied to a large number of configurations. The other class, called ballooning-type perturbation, does not always lead to an explicit form of criterion but some minimizations have to be carried out numerically. Near the magnetic axis, the two types of perturbations, though distinct, lead to the same results in any toroidal geometry. In axisymmetry (Tokomak-type) it is possible to obtain precise results which show that, away from the magnetic axis, the two criteria are different and any one of them may be more or less stringent according to the configuration considered. Author (NSA)

N74-12427# Sandia Labs., Albuquerque, N.Mex.
GEOMETRICAL EFFECTS ON THE SOURCE OF SPONTANEOUS LASER-GENERATED MAGNETIC FIELDS
T. P. Wright and M. M. Widner 1972 8 p refs Presented at the Plasma Phys. Meeting of the Am. Phys. Soc., Monterey, Calif., 13 Nov. 1972 Sponsored by AEC
(SC-DC-721536; Conf-721132-11) Avail: NTIS HC $3.00

The effect of laser target geometry on the self-generated magnetic fields is discussed. The production and properties of the self-generated fields are described. NSA

N74-12428# Sandia Labs., Albuquerque, N.Mex.
PARAMETRIC CORRELATIONS IN ENERGETIC LASER PLASMAS
J. N. Olsen, G. W. Kuswa, and E. D. Jones 1972 37 p refs

Presented at the Plasma Phys. Meeting of the Am. Phys. Soc., Montrey, Calif., 13 Nov. 1972 Sponsored by AEC
(SC-DC-721508; Conf-721132-10) Avail: NTIS HC $4.00

The analysis of LiH and LiD laser plasmas reveals correlations between the various parameters of each plasma event. Relationships are found involving the energy spectra of the ion speeds, the target reflectivity, neutron and hard X-ray production, the electron temperature and the input laser energy. Ion expansion spectra of nonthermal origin are observed under the condition of high target reflectivity. High target reflectance is correlated to neutron and hard X-ray production as well as decreased electron thermal content for laser energies of 18 to 70J. The ion expansion spectra are obtained with mass and charge separation by the parallel electric and magnetic fields of a Thomson parabola ion analyzer. A novel feature of this device is the conversion of the analyzed ion beam to a visible image via an electron multiplier array, providing complete information on a single shot basis.
Author (NSA)

N74-12429# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
LITERATURE SURVEY ON PLASMA INSTABILITIES COVERING 1971 PUBLICATIONS. PART 2: ABSTRACTS 218-435
G. Auer, F. Cap, and P. Shukla 31 Dec. 1972 309 p
(Contract F44620-72-C-0016; AF Proj. 9752)
(AD-757514; UNICP-SR95-PT-2; AFOSR-73-0490TR) Avail: NTIS CSCL 20/9

The report is the second part of the literature survey on plasma instabilities covering the year 1971. The volume contains 218 abstracts and the list of journals. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N74-12430 Oklahoma State Univ., Stillwater.
AN INVESTIGATION OF THE TRANSPORT PROPERTIES OF HOLES IN A SEMICONDUCTING DIAMOND Ph.D. Thesis
Leonard Chester Laskowski 1972 160 p
Avail: Univ. Microfilms Order No. 73-15173

The magnetoresistance for six orthogonal and three parallel orientations of the magnetic field and current, and the Hall coefficient for four orthogonal orientations of the magnetic field and current of the blue end of one semiconducting diamond were measured at the temperatures of 308 K and 436 K in pulsed magnetic fields up to 160 kilogauss. Most measurements were repeated twice using independent pairs of electrical probe contacts. Assuming that conduction in diamond is due to holes associated with three uncoupled valence bands, and assuming that the constant energy surfaces comprising the heavy hole, light hole, and split-off hole valence bands can, for small energies, be approximated respectively by a set of cubes, octahedrons, and spheres, the magnetoresistances and Hall coefficient factors at both temperatures were computed for the case of mixed scattering by acoustic lattice vibrations and ionized impurities.
Dissert. Abstr.

N74-12431 Kent State Univ., Ohio.
MOESSBAUER SPECTROSCOPY IN SMECTIC LIQUID CRYSTALS Ph.D Thesis
Jack M. Wilson 1972 109 p
Avail: Univ. Microfilms Order No. 73-13313

The first observation of the Mossbauer Effect in liquid crystals was accomplished with a mixture of 7% by weight 1-1 di-acetylferrocene (DAF) and 4-4 prime bis-heptyloxyazoxybenzene (HAB). In this case the sample was oriented in a magnetic field of four kilogauss while in the nematic phase and cooled to the smectic phase forming a uniformly oriented smectic monocrystal. The dependence of the sum of the peak heights, as a measure of the recoil-free fraction, on the angle, theta, between the direction of the gamma beam and the magnetic field was observed. The recoil-free fraction had a minimum at 30 deg. A systematic variation in the ratio of the areas of the two quadrupole split peaks as a function of theta was observed and attributed to the ordering of the DAF by the HAB structure. Dissert. Abstr.

N74-12432 Pennsylvania State Univ., University Park.
ELECTRICAL AND OPTICAL EFFECTS IN NATURALLY OCCURRING AND SYNTHETICALLY CREATED SUPERLATTICES Ph.D. Thesis
Walter Frederick Anderson, Jr. 1972 186 p
Avail: Univ. Microfilms Order No. 73-13948

A new form of the condensed state - the superlattice state - was synthetically produced and investigated. Such substances possess identity periods larger than the normal crystalline atomic spacing. The optical and electrical properties were studied. The investigation was divided into two parts. Naturally occurring superlattice structures were studied first and synthetically created superlattice structures were studied subsequently. The natural superlattice structures, beta - carotene and selenium, electrical transients were observed to be induced in these substances by high externally applied electric fields. The synthetically created superlattice structures showed unusual optical transmission properties. A relatively sharp optical transmission minimum was found to shift to shorter wavelengths with decreasing superlattice constant. The low field activation energy and the photoconductivity threshold were also found to be dependent on the superlattice constant. Dissert. Abstr.

N74-12433*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROTON-RADIATION DAMAGE IN GUNN OSCILLATORS
James W. Johnson and Carl L. Fales Washington Dec. 1973 28 p refs
(NASA-TN-D-7348; L-9042) Avail: NTIS HC $3.00 CSCL 20K

The irradiation effects of 22 MeV protons on the electrical characteristics of GaAs continuous-wave Gunn oscillators was studied. The radio frequency power output was reduced by 3 decibels at proton fluences in the neighborhood of 1.5 x 10 to the 12th power protons/sq cm. Conductance measurements indicate that the carrier removal rate at high electric fields remained roughly 40 percent less than at low fields. Diode efficiencies of two device groups were found to be monotonically descreasing functions of fluence. Frequency modulation noise was generally unaffected by radiation, but the magnitude of the noise in the noise power spectrum increased significantly. These effects are partially accounted for, in a qualitative fashion, by a model of electron traps having field-dependent net-carrier capture rates and various response times. Author

N74-12434*# Bowmar Canada, Ltd., Ottawa (Ontario). Research and Development Div.
FABRICATION AND PROPERTIES OF GALLIUM PHOSPHIDE VARIABLE COLOUR DISPLAYS Final Report, May 1972 - Jul. 1973
D. Effer, R. A. MacDonald, G. M. MacGregor, W. A. Webb, and D. I. Kennedy Jul. 1973 52 p refs
(Contract NAS1-11523)
(NASA-CR-132311) Avail: NTIS HC $4.75 CSCL 20L

The unique properties of single-junction gallium phosphide devices incorporating both red and green radiative recombination centers were investigated in application to the fabrication of monolithic 5 x 7 displays capable of displaying symbolic and alphanumeric information in a multicolor format. A number of potentially suitable material preparation techniques were evaluated in terms of both material properties and device performance. Optimum results were obtained for double liquid-phase-epitaxial process in which an open-tube dipping technique was used for n-layer growth and a sealed tipping procedure for subsequent p-layer growth. It was demonstrated that to prepare devices exhibiting a satisfactory range of dominant wavelengths which can be perceived as distinct emission colors extending from the red through green region of the visible spectrum involves a compromise between the material properties necessary for efficient red emission and those considered optimum for efficient green emission. Author

N74-12435*# Teledyne Systems Corp., Hawthorne, Calif.
SOLID STATE POWER CONTROLLERS Final Report
R. S. Gibbs 30 Aug. 1973 85 p refs
(Contract NAS9-12914)
(NASA-CR-134134) Avail: NTIS HC $6.25 CSCL 20L

The rationale, analysis, design, breadboarding and testing of the incremental functional requirements are reported that led to the development of prototype 1 and 5 Amp dc and 1 Amp ac solid state power controllers (SSPC's). The SSPC's are to be considered for use as a replacement of electro-mechanical relays and circuit breakers in future spacecraft and aircraft. They satisfy the combined function of both the relay and circuit breaker and can be remotely controlled by small signals, typically 10 mA, 5 to 28 Vdc. They have the advantage over conventional relay/circuit breaker systems in that they can be located near utilization equipment and the primary ac or dc bus. The low level control, trip indication and status signals can be circuited by small quage wire for control, computer interface, logic, electrical multiplexing, unboard testing, and power management and distribution purposes. This results in increased system versatility at appreciable weight saving and increased reliability. Author

N74-12436# California Univ., Berkeley. Lawrence Berkeley Lab.
THERMODYNAMICS OF SOLID-STATE SINTERING
C. E. Hoge Mar. 1973 32 p refs Presented at 3d Intern. Round Table Meeting on Sintering, Heroeg Novi, Yugoslavia, 3 Sep. 1973
(Contract W-7405-eng-48)
(LBL-1495; Conf-730905-1) Avail: NTIS HC $3.75

A thermodynamic analysis of solid-state sintering of a singlephase isotropic material of uniform particle size indicates that the ratio of the solid/solid and solid/vapor interfacial energies is critical; in order to realize ⁻eoretical density it must be smaller for less dense packings of unfired compacts. Another critical requirement is that pores must remain on grain boundaries during sintering. Pores on planar grain boundaries are effectively pinned. Curved grain boundaries can break away from pores when they achieve critical curvatures; this feature is essentially independent of the solid/solid and solid/vapor interfacial energies or the corresponding dihedral angle in the normal range of values. Nonuniform particle or grain-size distribution thus must be avoided since they lead to grain-boundary curvatures. Author (NSA)

N74-12437# Sandia Labs., Livermore, Calif.
EFFECTS OF RADIATIVE HEAT TRANSFER UPON THE MELTING AND SOLIDIFICATION OF SEMI-TRANSPARENT CRYSTALS
M. Abrams and R. Viskanta Feb. 1973 41 p refs
(Contract AT(29-1)-789)
(SCL-DC-720218; Conf-730803-1) Avail: NTIS HC $4.25

Employing the assumptions of one-dimensional energy transfer, equilibrium phase change, and negligible convection in liquid regions, the time-dependent conservation of energy equation is formulated for the general situation of n semi-transparent contiguous liquid and solid phases. Spectral optical properties of the media are modeled by band and gravy approximations. The dimensionless parameters governing the problem are identified, and the effects of their variation are ascertained by a finite-difference solution of the rigorously formulated energy and radiative transfer equations. The chief conclusions of this investigation are that for the range of parameters encountered in the melting and solidification of many optical materials, radiant transfer has a significant effect, and that during solidifiation, radiation can force the temperature profile within the liquid phase to assume a shape that leads to unstable interfacial growth. Author (NSA)

N74-12438# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
TRACE ANALYSIS USING ION ABRASION TECHNIQUES AND NUCLEAR REACTIONS
M. Bruel and E. Ligeon Sep. 1972 11 p refs In FRENCH Presented at Conf. on the Physico-Chem. and Elec. Characteristics of the Mater. and the Mfg. Procedures in the Field of Semiconductors, Grenoble, 27-29 Sep. 1972
(CEA-Conf-2247; Conf-720990-5) Avail: AEC Depository Libraries HC $3.00

A method using ion abrasion techniques in conjunction with nuclear reaction microanalysis is described. The system enabled direct measurements to be made of the concentration profiles using abrasion-counting as well as providing information about the distribution of impurities on the surface of samples. The principles of these measurements are given and the experimental equipment is described, particular attention being given to the ion abrasion device. The impurity profiles of boron in silicon and zinc telluride and phosphorus in silicon were revealed. NSA

N74-12439# McElroy (Ralph) Co., Austin, Tex. Customs Div.
EFFECT OF TWIST ON AC LOSS
Yoshio Furuto, Cho Ikeda, Shin-ichiro Meguro, and Itaru Inoue Jun. 1973 2 p Transl. into ENGLISH of the publ. "AC Rosu ni Okeru Tsuisto Kokai" Japan Prepared for Los Alamos Sci. Lab. Sponsored by AEC
(LA-tr-73-16) Avail: NTIS HC $3.00

To investigate combination current in composite superconducting twist wire, a type of two current model is adopted such that the current inside the superconductor is on the overlap of super electrons and normal electrons and the critical condition equations are derived. The calculation of the twist effect on ac loss is described. Here, a micro approach is taken in which it is calculated from the electric field and the current inside the conductor. NSA

N74-12440# Aerospace Corp., El Segundo, Calif. Lab. Operations.
OBSERVATION OF FERROELECTRIC DOMAINS WITH A SCANNING ELECTRON MICROSCOPE Report for Aug. - Dec. 1972
Armond B. Chase and Thomas S. Hartwick 27 Apr. 1973 17 p refs
(Contract F04701-73-C-0074)
(AD-766258; TR-0074(9230-01)-1; SAMSO-TR-73-239) Avail: NTIS CSCL 20/12

Ferroelectric domains are observed in several high resistivity ferroelectric crystals. High contrast observations are made with a commercial SEM in the secondary electron emission mode. Uncoated, as-grown crystal surfaces produce the highest contrast observations at the SEM resolution limit. The results recommend the SEM method as a practical technique for ferroelectric domain observations. Author (GRA)

N74-12441# Army Electronics Command, Fort Monmouth, N.J.
HIGH RESOLUTION DETECTION OF TRAPPED ELECTRON CHARGES IN Si O2 BY SCANNING ELECTRON MICROSCOPY
E. R. Ahlstrom, W. S. Wheeler, and C. F. Cook Oct. 1972 13 p refs
(DA Proj. 1B6-62703-A-440)
(AD-753916; ECOM-4036) Avail: NTIS CSCL 20/12

A novel method for detection of trapped charges in silicon dioxide (SiO2) is described. Traps that exist in the oxide are first charge by low energy electron bombardment. Then, illumination will ultraviolet (UV) light through a mask produces a latent image in the oxide. Subsequent exposure to a scanning electron microscope (SEM) reads out the image. The image sharpness is related to trap density. Author (GRA)

N74-12442*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
[ELECTRONICS RESEARCH PROJECTS ON SOLID STATE, PLASMA, ELECTRICAL AND BIOENGINEERING, AND BIOMATHEMATICS] Semiannual Progress Report, 30 Sep. 1972 - 1 Apr. 1973
Apr. 1973 103 p refs Sponsored jointly by NASA, NSF, HEW, DOT, and AEC
(Contract F44620-71-C-0067)
(NASA-CR-136227; SAPR-17; AD-766946) Avail: NTIS HC $7.25 CSCL 20/12

The following topics are considered: Materials and semiconductors; Quantum electronics; Magnetism; Metals, alloys, and low temperature physics; Solid state devices; Defect chemistry and solid state electrochemistry; Plasmas; Applied electromagnetics; Control systems; Communication systems; Computer

systems and automata theory; Electric power systems; Biomedical engineering and mathematical biosciences. GRA

N74-12612 INTEL Corp., Santa Clara, Calif.
N-CHANNEL RAMS
A. C. Markkula, Jr. *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

N74-12613 Motorola, Inc., Phoenix, Ariz.
SYSTEM APPLICATIONS FOR 4K RAM'S
Bud Broeker *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 1 p (For availability see N74-12580 03-10)
Copyright.

N74-12624 Hewlett-Packard Co., Palo Alto, Calif.
PERFORMANCE CHARACTERISTICS AND FUTURE APPLICATIONS OF LOW NOISE BIPOLAR TRANSISTORS
Sanehiko Kakihana *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 8 p (For availability see N74-12580 03-34)
Copyright.

N74-12625 Watkins-Johnson Co., Palo Alto, Calif.
PERFORMANCE CHARACTERISTICS AND FUTURE APPLICATIONS OF LOW NOISE GALLIUM ARSENIDE FET'S
John A. Eisenberg *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

N74-12653 Hewlett-Packard Co., Palo Alto, Calif.
LIQUID CRYSTAL DISPLAYS, THEIR PROBLEMS AND PROSPECTS
Sun Zu *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs (For availability see N74-12580 03-34)
Copyright.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N74-12443# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
MEASUREMENT OF THE EFFECTIVE STABILIZER CONTENT IN PROPELLANTS. SURVEILLANCE CONTROL OF SINGLE AND DOUBLE BASE PROPELLANTS
15 Aug. 1973 18 p refs
(TL-1973-20; Ass-9105-V) Avail: NTIS HC $3.00

The measurement of the effective stabilizer (MES) content in single and double base propellants was evaluated for surveillance and control. The MES and its operation are described as well as the handling of samples (grinding, drying and aging at 85 C). It is concluded that the MES performs well in surveillance control. Author

N74-12444*# Rocketdyne, Canoga Park, Calif.
POGO INSTABILITIES SUPPRESSION EVALUATION
E. C. Farrel and J. R. Fenwick Nov. 1973 134 p refs
(Contract NAS3-14382)
(NASA-CR-134500; R-9125) Avail: NTIS HC $8.75 CSCL 22B

A dynamic (frequency response) analysis is made of a liquid oxygen feed system consisting of a low-speed inducer, a high-speed main pump and a positive displacement pulser utilized for simulating POGO induced pressure oscillations. Based on the results of the analysis, an active control system for suppression of pulser generated pressure oscillations was designed, fabricated and tested. The test results verified that the suppressor was effective in attenuating the generated pressure oscillations over the frequency range from 10 to 30 Hz. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N74-12445*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EMISSION CALCULATIONS FOR A SCRAMJET POWERED HYPERSONIC TRANSPORT
Erwin A. Lezberg Nov. 1973 32 p
(NASA-TM-X-71464; E-7760) Avail: NTIS HC $3.75 CSCL 21E

Calculations of exhaust emissions from a scramjet powered hypersonic transport burning hydrogen fuel were performed over a range of Mach numbers of 5 to 12 to provide input data for wake mixing calculations and forecasts of future levels of pollutants in the stratosphere. The calculations were performed utilizing a one-dimensional chemical kinetics computer program for the combustor and exhaust nozzle of a fixed geometry dual-mode scramjet engine. Inlet conditions to the combustor and engine size was based on a vehicle of 227,000 kg (500,000 lb) gross take of weight with engines sized for Mach 8 cruise. Nitric oxide emissions were very high for stoichiometric engine operation but for Mach 6 cruise at reduced equivalence ratio are in the range predicted for an advanced supersonic transport. Combustor designs which utilize fuel staging and rapid expansion to minimize residence time at high combustion temperatures were found to be effective in preventing nitric oxide formation from reaching equilibrium concentrations. Author

N74-12446*# Rockwell International Corp., Canoga Park, Calif.
ADVANCED HYDROGEN/OXYGEN THRUST CHAMBER DESIGN ANALYSIS Final Report, Jul. 1972 - May 1973
J. M. Shoji Nov. 1973 252 p refs
(Contract NAS3-16774)
(NASA-CR-121213; R-9258) Avail: NTIS HC $14.75 CSCL 21H

The results are reported of the advanced hydrogen/oxygen thrust chamber design analysis program. The primary objectives of this program were to: (1) provide an in-depth analytical investigation to develop thrust chamber cooling and fatigue life limitations of an advanced, high pressure, high performance H2/O2 engine design of 20,000-pounds (88960.0 N) thrust; and (2) integrate the existing heat transfer analysis, thermal fatigue and stress aspects for advanced chambers into a comprehensive computer program. Thrust chamber designs and analyses were performed to evaluate various combustor materials, coolant passage configurations (tubes and channels), and cooling circuits to define the nominal 1900 psia (1.31 x 10 to the 7th power N/sq m) chamber pressure, 300-cycle life thrust chamber. The cycle life capability of the selected configuration was then determined for three duty cycles. Also the influence of cycle life and chamber pressure on thrust chamber design was investigated by varying in cycle life requirements at the nominal chamber pressure and by varying the chamber pressure at the nominal cycle life requirement. Author

N74-12447*# Owens-Illinois, Inc., Toledo, Ohio.
EXPLORATORY DEVELOPMENT OF A GLASS CERAMIC AUTOMOBILE THERMAL REACTOR
R. E. Gould and R. W. Petticrew Sep. 1973 33 p refs
(Contract NAS3-14334)
(NASA-CR-134531) Avail: NTIS HC $3.75 CSCL 21A

This report summarizes the design, fabrication and test results obtained for glass-ceramic (CER-VIT) automotive thermal reactors. Several reactor designs were evaluated using both engine-dynamometer and vehicle road tests. A maximum reactor life of about 330 hours was achieved in engine-dynamometer tests with peak gas temperatures of about 1065 C (1950 F). Reactor failures were mechanically induced. No evidence of chemical degradation was observed. It was concluded that to be useful for longer times, the CER-VIT parts would require a mounting system that was an improvement over those tested in this program.

A reactor employing such a system was designed and fabricated. Author

N74-12448*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN CONSIDERATIONS FOR THE AIRFRAME-INTEGRATED SCRAMJET
John R. Henry and Griffin Y. Anderson Washington Dec. 1973 38 p refs Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, France, Jun. 1972
(NASA-TM-X-2895; L-8152) Avail: NTIS HC $3.00 CSCL 21E

Research programs at the NASA Langley Research Center on the development of airframe-integrated scramjet concepts (supersonic combustion ramjet) are reviewed briefly. The design and performance of a specific scramjet configuration are examined analytically by use of recently developed and substantiated techniques on boundary-layer development, heat transfer, fuel-air mixing, heat-release rates, and engine-cycle analysis. These studies indicate that the fixed-geometry scramjet module will provide practical levels of thrust performance with low cooling requirements. Areas which need particular emphasis in further development work are the combustor design for low speeds and the integrated nozzle design. Author

N74-12449*# Pratt and Whitney Aircraft; West Palm Beach, Fla. Research and Development Center.
SINGLE-STAGE EXPERIMENTAL EVALUATION OF TANDEM-AIRFOIL ROTOR STATOR BLADING FOR COMPRESSORS. PART 6: DATA AND PERFORMANCE FOR STAGE D
D. R. Clemmons 30 Nov. 1973 270 p refs
(Contract NAS3-11158)
(NASA-CR-134511; PWA-FR-5852-Pt-6) Avail: NTIS HC $15.50 CSCL 21E

An axial flow compressor stage, having single-airfoil blading, was designed for zero rotor prewhirl, constant rotor work across the span, and axial discharge flow. The stage was designed to produce a pressure ratio of 1.265 at a rotor tip velocity of 757 ft/sec. The rotor had an inlet hub/tip ratio of 0.8. The design procedure accounted for the rotor inlet boundary layer and included the effects of axial velocity ratio and secondary flow on blade row performance. The objectives of this experimental program were: (1) to obtain performance with uniform and distorted inlet flow for comparison with the performance of a stage consisting of tandem-airfoil blading designed for the same vector diagrams; and (2) to evaluate the effectiveness of accounting for the inlet boundary layer, axial velocity ratio, and secondary flows in the stage design. With uniform inlet flow, the rotor achieved a maximum adiabatic efficiency of 90.1% at design equivalent rotor speed and a pressure ratio of 1.281. The stage maximum adiabatic efficiency at design equivalent rotor speed with uniform inlet flow was 86.1% at a pressure ratio of 1.266. Hub radial, tip radial, and circumferential distortion of the inlet flow caused reductions in surge pressure ratio of approximately 2, 10 and 5%, respectively, at design rotor speed. Author

N74-12450*# General Electric Co., Philadelphia, Pa.
ON THE DESIGN AND TEST OF A LIQUID INJECTION ELECTRIC THRUSTER Final Report
Theodore A. Jones, John T Kenney, and E. Howard Youmans [1973] 144 p refs
(Contract NAS1-11382)
(NASA-CR-132316) Avail: NTIS HC $9.25 CSCL 21C

A liquid injection electric thruster (LINJET) was designed and tested. The results of the tests were very encouraging with thruster performance levels well in excess of design goals. Supporting activities to the engine design and test included a five-million pulse life test on the main capacitor, a 46-million pulse test on the trigger electronics, design and fabrication of a zero resistance torque connector for use with the torsional pendulum thrust stand, design and fabrication of a logic box for control of engine firing, and a physical and chemical properties characterization of the perfluorocarbon propellant. While the results were encouraging, testing was limited, as many problems existed with the design. The most significant problem was involved with excessive propellant flow which contributed to false triggering and shorting. Low power active thermal control of the propellant storage cavity, coupled with a re-evaluation of the injection ring pore size and area exposed to the main capacitor discharge are areas that should be investigated should this design be carried forward. Author

N74-12451# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
INVESTIGATIONS ON ENERGY CONVERSION IN LIQUID ROCKETS IN CONNECTION WITH THRUST CONTROL Ph.D. Thesis - Brunswick Univ. [UNTERSUCHUNGEN UEBER DIE ENERGIEUMSETZUNG IN FLUESSIGKEITSRAKETEN IM ZUSAMMENHANG MIT SCHUBREGELUNG]
Winfried Buschulte Porz, West Ger. 8 Jun. 1973 237 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-79) Avail: NTIS HC $14.00; DFVLR, Porz, West Ger. 35,50 DM

The range of thrust variation necessary was deduced from some mission examples. To find the optimal flight path of satellite launchers, a diagram was made. Systems for determining the injector element sprays droplet diameter distributions and evaporation efficiency are explained. Suggestions are made for improving the predictability of mixing efficiencies of elements. An injector type and its performance are discussed. Effects of thrust control on the expansion process are dealt with. Test results from a CH2/LOX-throttleable rocket engine are presented and compared with theoretical results of the process study. ESRO

N74-12452# Rocket Propulsion Establishment, Westcott (England).
THE RADAR ECHOING AREA OF THE E573 ROCKET MOTOR EXHAUST JET
A. S. Wilson Feb. 1972 18 p refs
(RPE-TR-72/3; BR35150) Avail: NTIS HC $3.00

A model of the E 573 rocket motor exhaust jet was prepared. From this model, the echoing areas of the exhaust gases at three radar frequencies, C-band (5 GHz), X-band (10 GHz), and J- or Ku-band (15 GHz) were calculated. The variation of echoing area with aspect angle was determined, and it was shown that, for this particular exhaust jet and frequency range, the echoing area depends only slightly on transmitter frequency. The variation of echoing area, with position along the jet axis, and the frequency distribution of the scattered power are also shown. Author (ESRO)

N74-12453# Aeronautical Research Council, London (England).
AN OMNI-DIRECTIONAL VELOCITY VECTOR PROBE SUITABLE FOR USE IN GAS TURBINE COMBUSTORS. DESIGN DEVELOPMENT AND PRELIMINARY TESTS IN A MODEL COMBUSTOR
J. J. MacFarlane 1973 45 p refs Supersedes ARC-33887 (ARC-CP-1254; ARC-33887) Avail: NTIS HC $4.25; HMSO 70p; PHI $2.95

A technique which permits the construction of spherical multi-hole velocity vector probes in platinum/20% rhodium alloy is described. These probes are shown suitable for use at gas turbine primary flame temperatures while the head is sufficiently compact to permit use of the probe in model combustor research. Starting with an established design of 5-hole probe, a program of development is described which has led to a new design of 7-hole probe which can accept a vector from any direction in space. Tests were made in model primary zones to validate certain features of this design during its development. Author (ESRO)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N74-12454 Georgia Inst. of Tech., Atlanta.
AN EXPERIMENTAL STUDY OF CERTAIN NEUTRAL

COSMIC RAY INTERACTIONS Ph.D. Thesis
Charles Thomas Brown 1972 126 p
Avail: Univ. Microfilms Order No. 73-14083

During the past ten years experiments performed by others have yielded results that indicate an anomalously large rate of production of muons in large volume detectors by neutral components of the cosmic radiation. A further study of this phenomenon was undertaken with particular emphasis placed on an independent confirmation of the existence of an anomaly in the rate of production of muons by neutral components of the cosmic radiation. The available evidence indicated that the sea level cosmic ray neutron intensity is sufficient to account for the observed neutral-particle-induced muon rate in the detector. It is pointed out, however, that the errors in the two rates allow for up to 25 percent of the events to be due to processes other than pion production by incident neutrons. In conclusion, no obvious anomaly in the rate of production of muons by neutral components of the cosmic radiation was observed.
Dissert. Abstr.

N74-12455 Washington Univ., Seattle.
AN INVESTIGATION OF THE INFLUENCE OF AEROSOLS ON THE SOLAR RADIATION FIELD AND THE HEATING OF A MULTIPLE SCATTERING POLLUTED URBAN ATMOSPHERE Ph.D. Thesis
Paul David Try 1972 191 p
Avail: Univ. Microfilms Order No. 73-13895

A review of the background and theory behind the aerosol-radiation interaction including an extensive bibliography is followed by an investigation into the reflected, transmitted and absorbed solar radiation fields. A multiple scattering radiative transfer model is used to investigate the influence of surface albedo and various aerosol parameters on solar radiation and the heating in polluted urban atmospheres. The Gauss-Seidel iterative solution to the equation of radiative transfer is used in the model to determine the radiation field as a function of the aerosol composition, size distribution and concentration. Aerosol, NO2, and light scattering data from the Los Angeles, California area were used to characterize urban aerosol and gaseous pollutant features for use in the model. The model was used to determine the relative importance of the aerosol parameter and surface albedo uncertainties in atmospheric heating and earth-atmosphere albedo calculations. Dissert. Abstr.

N74-12456*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSSIBLE EVIDENCE FOR STRUCTURED ACCELERATION OF COSMIC RAYS ON A GALACTIC SCALE FROM RECENT GAMMA RAY OBSERVATIONS
F. W. Stecker, J. L. Puget (Obs. de Paris-Meudon, France), A. W. Strong (Durham Univ.), and J. H. Bredekamp Nov. 1973 13 p refs Submitted for publication
(NASA-TM-X-70521; X-641-73-350) Avail: NTIS HC #3.00 CSCL 03B

Recent data from SAS-2 on the galactic Gamma ray line flux as a function of longitude reveals a broad maximum in the region of < 30 deg. This data, as unfolded here, implies that the low-energy (1-10GeV) galactic cosmic-ray flux varies with the radial distance, omega, from the galactic center and is about an order of magnitude higher than the local value in a toroidal region for omega between 4 and 5 kpc. It is shown that this enhancement can be plausibly accounted for by Fermi acceleration caused by a hydrodynamic shock driven by the expanding gas in the 3 kpc arm and invoked in some versions of galactic structure theory. Author

N74-12457# University of Southern Calif., Los Angeles. Dept. of Physics.
HIGH SPEED STREAMS IN THE SOLAR WIND
D. S. Intriligator Asheville, N. C. Environmental Data Service Jun. 1973 12 p refs
(UAG-27) Avail: NTIS MF $1.45; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $0.15

A list is presented of the high speed solar wind proton streams observed in the interplanetary medium by the Ames Research Center solar wind spectrometer on the Pioneer 6, 7, 8, and 9 spacecraft. This is followed by a similar list based on the observations from the Vela 3, 4, 5A, and 5B satellites. The Pioneer list specifies all high speed streams that occurred between December 16, 1965 and June 30, 1971 for which there are data. There were many time intervals during which there was no ground tracking of the spacecraft. Author

N74-12458# Osservatorio Astronomico, Rome (Italy).
SOLAR PHENOMENA Monthly Bulletin, Aug. 1973
Massimo Cimino Aug. 1973 9 p
(Bull-184) Avail: NTIS HC $3.00

The solar observations of the Rome Observatory are reported. The data reported include: daily total areas of sunspot-groups; heliographic position, classification and area of sunsopt groups; hours of K-line cinematographic patrol; hours of H sub alpha cinematographic patrol; and SCNA AND SEA. F.O.S.

N74-12459*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
VARIATIONS IN THERMOSPHERIC COMPOSITION: A MODEL BASED ON MASS-SPECTROMETER AND SATELLITE-DRAG DATA
L. G. Jacchia 30 Nov. 1973 28 p refs
(Grant NGR-09-015-002)
(NASA-CR-136192; SAO-311-005; SAO-Special-Rept-354) Avail: NTIS HC $3.50 CSCL 03B

The seasonal-latitudinal and the diurnal variations of composition observed by mass spectrometers on the OGO 6 satellite are represented by two simple empirical formulae, each of which uses only one numerical parameter. The formulae are of a very general nature and predict the behavior of these variations at all heights and for all levels of solar activity; they yield a satisfactory representation of the corresponding variations in total density as derived from satellite drag. It is suggested that a seasonal variation of hydrogen might explain the abnormally low hydrogen densities at high northern latitudes in July 1964. Author

N74-12460# Potchefstroom Univ. for Christian Higher Education (South Africa). Dept. of Physics.
COSMIC RAY NEUTRON MONITOR DATA, SANAE, ANTARCTICA, JANUARY - DECEMBER 1973
1972 51 p
(S-7) Avail: NTIS HC $4.75

The counting rate of the 18 NM-64 monitor at Kiel is used for the graphical comparison of Sanae with another high counting rate high latitude neutron monitor. The normalization factors used for the graphical representation of the total corrected counting rates were 6528.9 for Kiel and 1462.0 for Sanae. Author

N74-12461# International Geophysical Year World Data Center A, Asheville, N.C
PRELIMINARY COMPILATION OF DATA FOR RETROSPECTIVE WORLD INTERVAL, 26 JULY - 14 AUGUST 1972
J. Virginia Lincoln, comp. and Hope I. Leighton, comp. Environmental Data Service Nov. 1972 133 p Sponsored by NOAA
(UAG-21) Avail: NTIS MF $1.45; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $0.70

The solar-terrestrial physics data available in early October 1972 for the period of unusual solar activity July 26 to August 14, 1972 are reported. The activity is associated with the transit of the McMath Plage Region 11976. Subjects discussed in the report include: (1) solar flare associated events, (2) riometer data, (3) ionospheric data, (4) cosmic ray measurements, (5) geomagnetic activity, and (6) auroral activity. Author

N74-12462*# Maryland Univ., College Park. Dept. of Mechanical Engineering.
AN ASSESSMENT OF SOLAR ENERGY AS A NATIONAL ENERGY RESOURCE
Dec. 1972 88 p refs Sponsored by NASA
(Grant NSF GI-32488)
(NASA-CR-136191; PB-221659; NSF/RA/N-73-001) Avail: NTIS HC $6.50 CSCL 03B

The findings of a panel on the development and application of solar energy to reduce the need for fossil fuels are presented. The applications which are considered most promising from technical, economic, and energy quantity standpoints are: (1) heating and cooling of residential and commercial buildings, (2)

chemical and biological conversion of organic materials to liquid, solid, and gaseous fuels, and (3) generation of electricity. Tables are presented to show the solar utilization techniques, major technical problems, and the impact of solar energy applications on the reference energy system. Author

N74-12463# Consiglio Nazionale delle Ricerche, Rome (Italy). Lab. di Ricerca e Tecnologia per lo Studio del Plasma nello Spazio.
ANGULAR DATA ANALYSIS TECHNIQUE FOR THE HEOS 1 SOLAR WIND EXPERIMENT
M. B. Cattaneo, A. Egidi, and C. Signorini Feb. 1972 19 p refs
(LPS-72-5) Avail: NTIS HC $3.00

A description of the S-73 and S-58 experiment is given together with the principle of the angular measurement routine. The physical location of experiment sensor and solar gates, the timing information provided by the spacecraft, and the actual spin period computation are detailed. The data reduction section deals with the computation of the limits of the angular sectors and with the accuracy, which is shown to be about 0.6 degree for the limits of the angular sectors and 0.00001 relative accuracy of the spin period after curve fitting. ESRO

N74-12464# Consiglio Nazionale delle Ricerche, Rome (Italy). Lab. di Ricerca e Tecnologia per lo Studio del Plasma nello Spazio.
REMARKS ON SOLAR WIND HEATING
E. Amata Mar. 1972 37 p refs
(LPS-72-7) Avail: NTIS HC $4.00

Solar wind heating calculations making use of Heos A satellite plasma probe results are presented. The data concerning the proton heat flux are not amenable to statistical treatment, although occasionally there exists a correlation between thermal gradients and non-Maxwellian tails. A relation between the bulk velocity and temperature is confirmed and appears to be an intrinsic property of positive ions. The proton heat flux is not affected by hourly averages or using values from single events. It is not affected by excluding velocity gradients periods. ESRO

N74-12678* Auburn Univ., Ala.
COMPONENTS FOR SOLAR ENERGY
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 14 p refs (For availability see N74-12674 03-34) CSCL 20M

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N74-12465 Yale Univ., New Haven, Conn.
AN INVESTIGATION OF STELLAR POPULATIONS AMONG G AND K GIANT STARS Ph.D. Thesis
Kenneth Allan Janes 1972 206 p
Avail: Univ. Microfilms Order No. 73-14343

Intermediate-band photometry on the DDO system has been used to investigate cyanogen band strengths in a large sample of bright G and K giant stars and in stars on the giant branches of the open clusters M67 and NGC 7789. The photometry has been calibrated to yield a surface-gravity-independent index of CN strength and an estimate of the absolute magnitude. In the course of deriving the absolute magnitude calibration, the relation between the width of the K-line emission and absolute magnitude was found to be nonlinear, a re-calibration of this relation was derived. Based on the CN strengths of cluster giants, M67 is not super-metal-rich, but has approximately solar composition. It is metal-poor with respect to the Hyades. No evidence is found in either cluster for intrinsic differences in the CN strengths among stars on the giant branch or clump. Dissert. Abstr.

N74-12466 Washington Univ., Seattle.
THE OB STELLAR ASSOCIATIONS IN THE LARGE MAGELLANIC CLOUD Ph.D. Thesis
Peter Barton Lucke 1973 309 p
Avail: Univ. Microfilms Order No. 73-13852

Results are presented of a photometric investigation of 98 of the 122 catalogued OB stellar associations in the Large Magellanic Cloud. Photographic photometry in two colors (B and V) of 4661 stars is used to construct color-magnitude diagrams and luminosity functions of the associations. Standard stars in the associations were measured photoelectrically in three colors (U, B, and V) for the purpose of calibrating the iris photometry. These standard stars permitted the determination of the interstellar reddening in or near many of the associations. Galactic foreground stars were distinguished from true Large Cloud members among the brightest stars, and the relationship between spectral type and position in the color-magnitude diagrams of the associations was studied. Many known variable stars were also measured. Dissert. Abstr.

N74-12467 Maryland Univ., College Park.
THE RELATIVISTIC ROCHE PROBLEM: BODIES IN EQUATORIAL, CIRCULAR ORBIT AROUND KERR BLACK HOLES Ph.D. Thesis
Leslie Gary Fishbone 1972 216 p
Avail: Univ. Microfilms Order No. 73-13631

Bodies in orbit around Kerr black holes will experience tidal gravitational forces. The equation of geodesic deviation, referred to from reference frames fixed in such bodies, reveal the nature of these factors. Analysis is performed for all circular, equatorial, geodesic orbits of the Kerr metric whose mass parameter M and angular momentum parameter Ma satisfy A smaller than or = M (geometrical limits). Free-particle motion, which the deviation equation describes, is simple harmonic in the direction perpendicular to the equatorial plane, and the relation between the angular frequency of this simple harmonic motion and the circular orbit frequency is demonstrated. Centrifugal effects also appear, and from the angular frequency which characterize them. The geodetic precession of local inertial axes which move in circular orbits is deduced. The equation for free-particle motion leads to a generalized Euler equation that decribes fluid flow in the orbiting reference frames. Dissert. Abstr.

N74-12468 Princeton Univ., N.J.
DYNAMICS OF ROTATING STELLAR SYSTEMS: COLLAPSE AND VIOLENT RELAXATION Ph.D. Thesis
John Richard Gott, III 1972 66 p
Avail: Univ. Microfilms Order No. 73-18761

A method for following the dynamics of axisymmetric stellar systems is developed and applied to the problem of collapse and violent relaxation in rotating stellar systems. Utilization of an axisymmetric gravitational potential allows treatment of many more stars than would be feasible with a simple N-body calculation. Systems having differing amounts of initial angular momentum and containing 2000 stars each are allowed to collapse under their own gravitational attraction. Collapse and violent relaxation are found to lead to the formation of equilibrium structures after only a few free fall times. The systems contain a sufficient number of stars so as to be effectively collisionless and the equilibrium structures are consistent with accurate satisfaction of the stationary collisionless Boltzmann equation. Dissert. Abstr.

N74-12469 Ohio State Univ., Columbus.
MONTE CARLO ANALYSIS OF THE RADIO SOURCE COUNTS FROM THE OHIO SURVEY AT 1415 MHz Ph.D. Thesis
Chunchanakatte Melukote Ramakrishina 1973 208 p
Avail: Univ. Microfilms Order No. 73-18942

A Monte Carlo analysis was made to determine the errors in flux density and position of radio sources in the Ohio Survey. Selecting a few strong point sources from Survey V the beam pattern of the O.S.U. radio telescope was determined. Using this antenna pattern Monte Carlo sources were generated and combined with the raw data pertaining to the blocks OG5 and OH5. The modified data were analysed in exactly the same way as were the original data. From the resulting radio source maps, called Monte Carlo maps, sources were selected and their flux and positions determined. Each Monte Carlo map was compared with the original map and the Monte Carlo sources

extracted. Noting the differences in the detected flux and positions as compared to the original the systematic and the RMS errors in flux and position were computed. From the percentage of sources lost and errors in flux densities the corrections to the number counts were determined. Dissert. Abstr.

N74-12470 Illinois Univ., Urbana.
OPTIMAL MULTIPLE-IMPULSE DIRECT ASCENT RENDEZVOUS Ph.D. Thesis
Larry Raymond Gross 1972 115 p
Avail: Univ. Microfilms Order No. 73-17222

Minimum fuel, multiple impulse, direct ascent rendezvous trajectories with a specified transfer time are investigated. The target's orbit is a circle about a spherical nonrotating planet. The angle between the launch point and the target's orbital plane, the radius of the target's orbit and the target's position at launch and at rendezvous are parameters varied in this study. A general method for obtaining fuel optimal, impulsive, fixed time trajectories is presented. The method is based on a comparison of two neighboring trajectories, a nonoptimal reference trajectory and a comparison trajectory. The properties of the primer vector along the reference trajectory provides information about the relative position of the comparison trajectory necessary to achieve a first order decrease in fuel cost. This information is used in a first order numerical minimization scheme to compute an optimal trajectory. Dissert. Abstr.

N74-12471 Illinois Univ., Urbana.
A SURVEY OF THE PROPERTIES OF SUPERNOVA REMNANTS Ph.D. Thesis
Anthony Gordon Willis 1972 209 p
Avail: Univ. Microfilms Order No. 73-18209

Sixteen galactic supernova remnants have been mapped at a frequency of 2.7 GHz with the 93 meter radio telescope of the National Radio Astronomy Observatory. The resolution, about 5.2 minutes of arc, is the highest yet attained on many of the sources. Except for the supernova remnant HB 21, good positional correspondence between the region of the peak volume emissivity at 2.7 GHz and the site of the optical filaments is found in those remnants exhibiting optical emission. It is suggested that a model of supernova remnant evolution which includes macroscopic turbulence in the shell where the radio emission originates would be in better agreement with the observed data. Dissert. Abstr.

N74-12472 Wisconsin Univ., Madison.
MEASUREMENT OF THE D/H RATIO IN THE ATMOSPHERE OF JUPITER WITH A PEPSIOS SPECTROMETER Ph.D. Thesis
John Terry Trauger 1973 80 p
Avail: Univ. Microfilms Order No. 73-15994

An estimate of the D/H ratio in the atmosphere of Jupiter has been made on the basis of an investigation of the sparse Jovian H2 quadrupole and HD dipole spectra between 6300 and 7500 A with an off-axis PEPSIOS spectrometer. The off-axis PEPSIOS, which was developed and first used in connection with this experiment, makes it possible to compensate for the Doppler shifts in the Jovian spectrum which result from its rapid rotation. As a consequence, it is possible to collect the light from the entire Jovian disk without degrading the spectral resolution. The characteristics of the Doppler compensating instrument that were essential in this experiment were an order of magnitude increase in light available to the spectrometer at the resolutions used compared to conventional spectrometers, and the property of the instrument which makes the solar and terrestrial lines normally present in the Jovian spectrum appear broad compared to planetary lines. Dissert. Abstr.

N74-12473 Texas Univ., Austin.
OPTIMAL THREE DIMENSIONAL REENTRY TRAJECTORIES FOR SHUTTLE TYPE VEHICLES Ph.D. Thesis
Ronald Wilson Greene 1972 110 p
Avail: Univ. Microfilms Order No. 73-18432

The perturbation method, a numerical optimization technique, is used to compute optimal three dimensional reentry trajectories for shuttle-type vehicles. In this study, the earth is assumed to be spherical, non-rotating, and to possess an inverse square gravitational force field. The atomsphere is assumed to be at rest with respect to the earth and its density is assumed to vary exponentially with altitude. The vehicle is controlled by modulation of the roll angle which determines the direction of the aerodynamic lift force and by variation of the angle of attack which determines the magnitude of the aerodynamic force coefficients. The aerodynamic lift and drag coefficients are assumed to be functions only of angle of attack and to be those obtained from Newtonian flow theory. Dissert. Abstr.

N74-12474 Washington Univ., Seattle.
THE ATMOSPHERIC STRUCTURE AND CHEMICAL COMPOSITION OF COOL HELIUM AND CARBON WHITE DWARFS Ph.D. Thesis
Thomas Cameron Grenfell 1972 206 p
Avail: Univ. Microfilms Order No. 73-13826

The atmospheric parameters are found which determine the atmospheric structure of the white dwarfs van Maanen 2 (DG), G47-18 (lambda 4670) and G99-37 (lambda 4670). L145-141 (DC) is also investigated. Spectral observations were carried out at Cerro Tololo Interamerican Observatory for the purpose of analyzing L145-141. The lambda 4670 feature (1962) is not confirmed in this star, and it should probably be classified as DC. Spectral data for the other stars are taken from various publications. For van Maanen 2 (vMa 2) the spectra are calibrated using the photoelectric scans. Model atmospheres are calculated for these stars. The initial approximations for the atmospheric parameters for vMa 2 are taken to be log g = 8. The initial effective temperature of vMa 2 is 5500 K, and the effective temperatures of G47-18 and G99-37 are estimated from a grid of models. Dissert. Abstr.

N74-12475 California Inst. of Tech., Pasadena.
IONIZATION STRUCTURE AND EMISSION LINE INTENSITIES OF SEYFERT GALAXY NUCLEI Ph.D. Thesis
Gregory Alan Shields 1973 126 p
Avail: Univ. Microfilms Order No. 73-14316

The ionizing radiation spectrum, geometry, and chemical abundances of the nuclei of the Seyfert galaxies NGC 1068 and 3C 120 are studied with the aid of detailed computer models. These objects represent opposite extremes of the Seyfert galaxy spectral types, but analysis indicates that they are similar in ionizing radiation and nebular geometry. The quantitative success of the models for the high excitation lines supports the idea that photoionization by a central continuum source is the ionization mechanism. However, the low excitation lines may indicate the importance of another process. The most attractive explanation of the observations of both 3C 120 and NGC 1068 involves ionizing radiation similar to that from a black body at 175,000 K. Important constraints provided by existing radio, infrared, and X-ray observations are discussed, and the importance of ultraviolet measurements is emphasized. Dissert. Abstr.

N74-12476 California Univ., San Diego.
A DUST-RADIATION INSTABILITY IN IONIZED NEBULAE, THE ANGULAR MOMENTUM OF SPIRAL GALAXIES, AND A SEARCH FOR CIRCULAR POLARIZATION IN EXTRAGALACTIC OBJECTS Ph.D. Thesis
Kenneth Hugh Nordsieck 1973 96 p
Avail: Univ. Microfilms Order No. 73-11978

Five self-contained papers on three unrelated topics of astrophysical interest are reported. First, an instability analysis of a nebula containing ionized hydrogen gas, absorbing dust, and Lyman-alpha line radiation is considered. Second a re-analysis of presently available rotation data for spiral galaxies is presented, with the aim of determining their angular momentum. A new method of rotation curve ananysis, is described which necessary to derive the mass distribution in outlying parts of the galaxy where the angular momentum is expected to reside. Finally, a short observational program investigating possible circularly polarized optical radiation from the nuclei of Seyfert galaxies and from Quasi-Stellar Objects is described. It is shown that in its automatic mode, the modified two-channel linear polarimeter that was used can simultaneously detect all the polarization information in the incoming light through a two-frequency modulation of the difference between the two signals. Dissert. Abstr.

N74-12477 California Univ., Los Angeles.
H ALPHA EMISSION-LINE STARS IN THE LARGE MAGELLANIC CLOUD: A NEW SURVEY WITH PHOTOGRAPHIC PHOTOMETRY Ph.D. Thesis
Bruce Edward Bohannan 1973 146 p
Avail: Univ. Microfilms Order No. 73-13128

The LMC was surveyed for stars with H alpha in emission, the first symptom of mass-loss observable in the visible region. Two epochs of objective prism plates, 1968 and 1970, were surveyed to obtain a complete survey to R=14.5. The survey is complete to an estimated 90 per cent at R=15.5. The survey yielded 625 stellar-like objects in the Large Cloud with H alpha in emission. Photographic photometry of the survey stars is included to define the domain in the color-magnitude diagram occupied by the H alpha emission line stars. The observed distribution of color index, B-V, is wide. (OB-V + Om .4). This results from imprecision in determination of the field effects of the photographic photometry, rather than from an intrinsic property of the survey stars. The survey stars are compared with various groups of stars in the Galaxy and in the LMC with respect to their color-magnitude diagrams and to their luminosity functions. Dissert. Abstr.

N74-12478*# Carnegie-Mellon Univ., Pittsburgh, Pa.
LAUNCH WINDOW ANALYSIS OF SATELLITES IN HIGH ECCENTRICITY OR LARGE CIRCULAR ORBITS Final Report
Marc L. Renard, S. K. Bhate, and R. Sridharan 15 Sep. 1973 282 p refs
(Grant NGR-39-087-001)
(NASA-CR-132875) Avail: NTIS HC $16.25 CSCL 22C

Numerical methods and computer programs for studying the stability and evolution of orbits of large eccentricity are presented. Methods for determining launch windows and target dates are developed. Mathematical models are prepared to analyze the characteristics of specific missions. Author

N74-12479*# Southern Univ., Baton Rouge, La. Dept. of Physics.
MANY-PARTICLE THEORY OF NUCLEAR SYSTEMS WITH APPLICATION TO NEUTRON STAR MATTER
Dennis A. Chakkalakal and Chia-H. Yang 12 Oct. 1973 29 p refs Prepared for JPL
(Grant NGR-19-005-006; Contract JPL-953549)
Avail: NTIS HC $3.50 CSCL 03B

The research is reported concerning energy-density relation for the normal state of neutron star matter, and the effects of superfluidity and polarization on neutron star matter. Considering constraints on variation, and the theory of quantum fluids, three methods for calculating the energy-density range are presented. The effects of polarization on neutron star structure, and polarization effects on condensation and superfluid-state energy are discussed. F.O.S.

N74-12480*# Illinois Univ., Urbana. Aeronomy Lab.
ANALYSIS OF PARTIAL-REFLECTION DATA FROM THE SOLAR ECLIPSE OF 10 JUL. 1972
T. A. Bean and S. A. Bowhill 1 Oct. 1973 128 p refs
(Grant NGR-14-005-181)
(NASA-CR-136123; Rept-55; UILU-Eng-73-2505) Avail: NTIS HC $8.50 CSCL 03A

Partial-reflection data collected for the eclipse of July 10, 1972 as well as for July 9 and 11, 1972, are analyzed to determine eclipse effects on D-region electron densities. The partial-reflection experiment was set up to collect data using an on-line PDP-15 computer and DECtape storage. The electron-density profiles show good agreement with results from other eclipses. The partial-reflection programs were changed after the eclipse data collection to improve the operation of the partial-reflection system. These changes were mainly due to expanded computer hardware and have simplified the operations of the system considerably. Author

N74-12481*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ABSORPTION OF TRAPPED PARTICLES BY JUPITER'S MOONS
W. N. Hess (NOAA, Boulder, Colo.), T. J. Birmingham, and G. D. Mead Nov. 1973 20 p refs
(NASA-TM-X-70522; X-641-73-362) Avail: NTIS HC $3.00 CSCL 03B

Absorption effects of the four innermost moons in the radial transport equations for electrons and protons in Jupiter's magnetosphere are presented. The phase space density n at 2 R sub J for electrons with equatorial pitch angles less than 69 deg is reduced by a factor of 4.2 x 1000 when lunar absorption is included in the calculation. For protons with equatorial pitch angles less than 69 deg, the corresponding reduction factor is 3.2 x 100000. The effect of the satellites becomes progressively weaker for both electrons and protons as equatorial pitch angles of pi/2 are approached, because the likelihood of impacting a satellite becomes progressively smaller. The large density decreases which we find at the orbits of Io, Europa, and Ganymede result in corresponding particle flux decreases that should be observed by spacecraft making particle measurements in Jupiter's magnetosphere. The characteristic signature of satellite absorption should be a downward pointing cusp in the flux versus radius curve at the L-value corresponding to each satellite. Author

N74-12482*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE ORBITAL MECHANICS OF FLIGHT MECHANICS
Robert Scott Dunning Washington 1973 164 p refs
(NASA-SP-325) Avail: NTIS HC $4.75 CSCL 22A

A reference handbook on modern dynamic orbit theory is presented. Starting from the most basic inverse-square law, the law of gravity for a sphere is developed, and the motion of point masses under the influence of a sphere is considered. The reentry theory and the orbital theory are discussed along with the relative motion between two bodies in orbit about the same planet. Relative-motion equations, rectangular coordinates, and the mechanics of simple rigid bodies under the influence of a gravity gradient field are also discussed. F.O.S.

N74-12483*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MISSION REQUIREMENTS: SKYLAB RESCUE MISSION SL-R
24 Aug. 1973 42 p refs
(NASA-TM-X-69477; JSC-I-MRD-001G-Vol-4) Avail: NTIS HC $4.25 CSCL 22A

The Skylab Program includes three low earth orbit missions. These missions are designated SL-1/SL-2,SL-3 and SL-4. In addition to the three nominal Skylab missions, the program includes the Skylab Rescue Mission (SL-R). The SL-R mission is designed to provide a safe return of the Skylab crew in the event the Command Service Module (CSM) becomes disabled while docked to the Saturn Workshop (SWS). Mission requirements for the SL-R mission only are presented. SL-R mission configuration will be a CSM (modified with a field installed kit) manned by two crewmen launched on a Saturn IB Launch Vechicle. The SL-R CSM will rendezvous and dock with the SWS (or Orbital Assembly (OA), consisting of the SWS and disabled CSM, if the disabled CSM has not previously been jettisoned). The SWS configuration includes a Multiple Docking Adapter (MDA), Apollo Telescope Mount (ATM), Airlock Module (AM), and an S-IVB stage (modified as an Orbital Workshop (OWS), previously launched and inserted into orbit on a two-stage Saturn V Launch Vehicle for the SL-1/SL-2 mission. Author

N74-12484*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ALTERNATE MULTIPLE-OUTER-PLANET MISSIONS USING A SATURN-JUPITER FLYBY SEQUENCE
John W. Young and Margery C. Hannah Washington Dec. 1973 27 p refs
(NASA-TN-D-7378; L-9005) Avail: NTIS HC $3.00 CSCL 22A

A study has been made of a method for providing more frequent launch opportunities for multiple-planet Grand Tour type missions to the outer solar system. A Saturn-Jupiter flyby sequence was used in the analysis to initiate the mission instead of the normal Jupiter-Saturn sequence. The Saturn-first approach is shown to yield several new launch opportunities following the 1980 cutoff date for Jupiter-first missions. Results are given for various two-planet, three-planet, and four-planet Jupiter-first and

Saturn-first missions. A unique five-planet Saturn-first mission and a Saturn-Jupiter flyby which returns to earth are also discussed. Mission performance is evaluated for each flyby technique by comparing Saturn-first and Jupiter-first missions with respect to launch energy requirements, available launch windows, planetary encounter conditions, and total mission times. Author

N74-12485*# Martin Marietta Corp., Denver, Colo.
STUDY OF 1980 COMET ENCKE-ASTEROID MISSIONS USING A SPIN-STABILIZED SPACECRAFT. VOLUME 1: SUMMARY REPORT
W. J. Bursnall Oct. 1973 34 p ref
(Contract NAS2-7564)
(NASA-CR-114670) Avail: NTIS HC $3.75 CSCL 22A

As a contribution to improved understanding of early comet exploration options, independent studies were undertaken which resulted in the identification of a number of fast flyby mission options for the 1980 apparition of Encke. The primary impetus for this approach was the prospect of utilizing existing launch vehicles and conventional spacecraft technology. In addition, timely experience and scientific data gained through an early fast flyby could prove valuable in implementing more ambitious succeeding missions, including a flyby of Comet Halley in 1986. Author

N74-12486*# Martin Marietta Corp., Denver, Colo.
STUDY OF 1980 COMET ENCKE-ASTEROID MISSIONS USING A SPIN-STABILIZED SPACECRAFT. VOLUME 2: TECHNICAL REPORT
W. J. Bursnall, E. G. Howard, W. R. McMinimy, R. G. Shaffer, and J. M. VanPelt Oct. 1973 373 p refs
(Contract NAS2-7564)
(NASA-CR-114671) Avail: NTIS HC $20.75 CSCL 22A

The data and analyses that support the conclusions and recommendations of a space mission to intercept comets and asteroids are presented. The scientific basis for the Encke missions is discussed and includes a summary of the physical characteristics of Encke, a statement of scientific objectives and priorities, a definition of the spacecraft payload, and a rationale for utilization and instrumentation of coma probes. Data are included for the reference mission selected as the baseline for science analysis and design studies. Alternate spacecraft configurations are compared in terms of their capability in meeting the science and mission requirements. Author

N74-12487# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 312
13 Nov. 1973 77 p refs Transl. into ENGLISH from various Soviet bloc periodicals
(JPRS-60528) Avail: NTIS HC $6.00

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Author

N74-12488# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 313
27 Nov. 1973 89 p refs Transl. into ENGLISH from Sino-Soviet Bloc publications
(JPRS-60632) Avail: NTIS HC $6.50

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Author

N74-12489# Smithsonian Astrophysical Observatory, Cambridge, Mass.
LUNAR PERTURBATIONS ON ARTIFICIAL SATELLITES OF THE EARTH
Giorgio E. O. Giacaglia 1 Oct. 1973 66 p refs
(NASA-CR-136224; SAO-Special-Rept-352) Avail: NTIS HC $5.50 CSCL 22C

Lunisolar perturbations for general terms of the disturbing function were derived by Kaula (1962). However, his formulas use equatorial elements for the moon and do not give a definite algorithm for computational procedures. As Kozai (1966) suggested, both inclination and node of the moon's orbit with respect to the equator of the earth are not simple functions of time, while the same elements with respect to the ecliptic are well approximated by a constant and a linear function of time, respectively. In the present work, the disturbing function is obtained for the moon's perturbations using ecliptic elements for the moon and equatorial elements for the satellite. Secular, long-period, and short-period perturbations are then computed, with the expressions kept in closed form in both inclination and eccentricity of the satellite. Alternative expressions for short-period perturbations of high satellites are also given, assuming small values of the eccentricity. The moon's position is specified by the inclination, node, argument of perigee, true (or mean) longitude, and its radius vector from the center of the earth. The results can then be applied to numerical integration by using coordinates of the moon from ephemeris tapes or to analytical representation by using results from lunar theory, with the moon's motion represented by a precessing and rotating elliptical orbit. Author

N74-12490# Naval Research Lab., Washington, D.C.
A STRONG VARIABLE SOURCE OF HARD X-RAYS IN THE CONSTELLATION, COMA BERENICES
L. S. Bratolyubova-tsulukidze, N. L. Grigorov, B. P. Kolesnikov, M. I. Kudryavtsev, A. S. Melioranskii, I. A. Savenko, and Yu. S. Fursov 10 Aug. 1973 5 p refs Transl. into ENGLISH from Astron. Fsirk. (USSR), no. 762, 12 Mar. 1973 p 4-6
(AD-766627; NRL-Trans-1268) Avail: NTIS CSCL 03/2

A spectrometer for hard X-radiation was installed aboard the Kosmos-428 artificial earth satellite (1). The detector consisted of a scintillation counter with a CsI(T1) crystal, 30 mm deep and 80.0 mm in diameter. The preliminary data from thirty revolutions of the satellite are reported here. A strong variable source of hard X-rays was found on 24-25 June 1972 in the region of the constellation Coma Berenices. GRA

N74-12491# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PROTON AND ALPHA PARTICLE FLUXES OBSERVED ABOARD OV5-6 IN AUGUST 1972
G. K. Yates, L. Katz, B. Sellers, and F. A. Hanser Jul. 1973 9 p Repr. from World Data Center A for Solar Terrest. Phys. (Colo.), UAG-28-Pt-2 p 348-353
(AF Proj. 8600)
(AD-766535; AFCRL-TR-73-0539; UAG-28-Pt-2) Avail: NTIS CSCL 03/2

Satellite OV5-6 (International designation 1969-046B) measures fluxes of protons and alpha particles. The perigee is 16,341 km and the apogee is 112, 196 km. Thus, for most of the time the instruments are outside the earth's magnetosphere. Data are presented of these fluxes outside the magnetosphere during the period 2-11 August 1973, a time of large solar produced particle influxes. Thirty minute averages of the data for selected energy intervals are given. These fluxes are given in particles/sq cm-sec-sr-MeV. Spectra at certain times during the event are also presented. Author (GRA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N74-12492 Ohio State Univ., Columbus.
THE METRIC CARTOGRAPHIC POTENTIAL OF GEOSTATIONARY/GEOSYNCHRONOUS SATELLITES Ph.D. Thesis
Louis Henry Knipling, Jr. 1973 273 p
Avail: Univ. Microfilms Order No. 73-18916

The metric cartographic potential of a satellite camera orbiting at 35,786 kms about the earth was investigated. Major pertinent areas contributing to the determination of this potential were investigated and reported. These areas include: the geosynchron-

ous orbit, design requirements of a suitable telescopic space camera, the effects of geophysical phenomena upon the imagery, the imagery sensors, the electronic transmission link, and the accuracy requirements for maps. It is concluded that the 15 meter focal length system has the capability of acquiring photography to support Class A mapping at a scale of 1:800,000 when no ground control is available and Class A mapping at a scale of 1:35,000 when ground control of 1 meter accuracy is present. The 45 meter camera can support mapping of 1:350,000, Class A when no ground control is present and Class A mapping of scale 1:35,000 when ground control of 1 meter accuracy is introduced into the solution. Dissert. Abstr.

N74-12493*# Aerospace Corp., El Segundo, Calif. Systems Planning Div.
SPACE SHUTTLE/PAYLOAD INTERFACE ANALYSIS (STUDY 2.4). VOLUME 1: EXECUTIVE SUMMARY Final Report
Ernest I. Pritchard 31 Aug. 1973 23 p
(Contract NASw-2472)
(NASA-CR-136125; ATR-74(7334)-1-Vol-1) Avail: NTIS HC $3.25 CSCL 22B

The space shuttle/payload interface analysis is presented. The analysis consists of the following sections: (1) payload capture and cost analysis, (2) business risk and value of operations in space analysis, and (3) payload community analysis. The primary objective of the study was to furnish a method for tracing capture/cost analyses conducted by other study groups. Author

N74-12494*# New York Univ., N.Y. Aerospace Lab.
REYNOLDS NUMBER AND MACH NUMBER EFFECT ON SPACE SHUTTLE CONFIGURATIONS Semiannual Report, 1 Mar. - 31 Aug. 1973
Victor Zakkay 31 Aug. 1973 23 p refs
(Grant NGR-33-016-179)
(NASA-CR-132264) Avail: NTIS HC $3.25 CSCL 22B

Analytical studies have been conducted concerning the lee-surface flow phenomena over a space shuttle orbiter model based on the experimental data obtained during September, 1971 through August, 1972. Lee-surface peak heating phenomena and flow separation patterns were analyzed. Major results of analyses are briefly presented. Author

N74-12495*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SATURN ILLUSTRATED CHRONOLOGY: SATURN'S FIRST ELEVEN YEARS, APRIL 1957 - APRIL 1968
David S. Akens 20 Jan. 1971 306 p refs
(MHR-5; NASA-CR-136149) Avail: NTIS HC $17.50 CSCL 22B

A history of the Saturn launch vehicles is presented for the period of April 1957 to April 1958. F.O.S.

N74-12496*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS ON AN 0.030-SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS, VOLUME 3
R. H. Spangler (Rockwell Int.) Oct. 1973 753 p
(Contract NAS9-13247)
(NASA-CR-128794-Vol-3; DMS-DR-2032-Vol-3) Avail: NTIS HC $39.75 CSCL 22B

Tests were conducted in the NASA/ARC Unitary Plan Wind Tunnels during April and May 1973, on an 0.030-scale replica of the Space Shuttle Vehicle Configuration 2A. Aerodynamic loads data were obtained at Mach numbers from 0.6 to 3.5. The investigation included tests IA9A, B and C on the integrated (launch) configuration and tests OA12A and C on the isolated orbiter (entry configuration). The integrated vehicle was tested at angles of attack and sideslip from -8 degrees to +8 degrees. The isolated orbiter was tested at angles of attack from -15 degrees to +40 degrees and angles of sideslip from -10 degrees to +10 degrees to as dictated by trajectory considerations. The effects of orbiter/external tank incidence angle and deflected control surfaces on aerodynamic loads were also investigated. Author

N74-12497*# Techtran Corp., Glen Burnie, Md.
THE SPACELAB PROGRAM
J. P. Causse Washington NASA Nov. 1973 22 p ref Transl. into ENGLISH from Communication presentee au 24eme Congres International d'Astronautique, Bakou, Oct. 1973 11 p
(Contract NASw-2485)
(NASA-TT-F-15205) Avail: NTIS HC $3.25 CSCL 22B

The Spacelab program is discussed. Topics include: project conceptualization, general organization, Spacelab users, shuttle interfaces, crew, models, and configurations. Decisions which must be made in these areas by European governments are also discussed. Author

N74-12498*# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
CATALYSIS STUDY FOR SPACE SHUTTLE VEHICLE THERMAL PROTECTION SYSTEMS Final Report
J. Breen, D. E. Rosner, W. N. Delgass, P. C. Nordine, R. Cibrian, and N. G. Krishnan 4 Oct. 1973 148 p refs
(Contract NAS9-13058)
(NASA-CR-134124) Avail: NTIS HC $9.50 CSCL 22B

Experimental results on the problem of reducing aerodynamic heating on space shuttle orbiter surfaces are presented. Data include: (1) development of a laboratory flow reactor technique for measuring gamma sub O and gamma sub N on candidate materials at surfaces, T sub w, in the nominal range 1000 to 2000, (2) measurements of gamma sub O and gamma sub N above 1000 K for both the glass coating of a reusable surface insulation material and the siliconized surface of a reinforced pyrolyzed plastic material, (3) measurement of the ablation behavior of the coated RPP material at T sub w is greater than or equal to 2150 K, (4) X-ray photoelectron spectral studies of the chemical constituents on these surfaces before and after dissociated gas exposure, (5) scanning electron micrograph examination of as-received and reacted specimens, and (6) development and exploitation of a method of predicting the aerodynamic heating consquences of these gamma sub O(T sub w) and gamma sub N(T sub w) measurements for critical locations on a radiation cooled orbiter vehicle. Author

N74-12499*# AiResearch Mfg. Co., Torrance, Calif.
DESICCANT HUMIDITY CONTROL SYSTEM Final Report
J. Amazeen, ed. 17 Sep. 1973 115 p
(Contract NAS9-12956)
(NASA-CR-134126; Rept-73-9313) Avail: NTIS HC $7.75 CSCL 06K

A regenerable sorbent system was investigated for controlling the humidity and carbon dioxide concentration of the space shuttle cabin atmosphere. The sorbents considered for water and carbon dioxide removal were silica gel and molecular sieves. Bed optimization and preliminary system design are discussed along with system optimization studies and weight penalites. F.O.S.

N74-12500*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE LIGHTING PROTECTION CRITERIA DOCUMENT
Sep. 1973 68 p
(NASA-TM-X-69454; JSC-07636) Avail: NTIS HC $5.50 CSCL 22B

The lightning environment for design is defined and imposes the requirements that the design must satisfy to insure the protection of the space shuttle vehicle system from the direct and indirect effects of lightning. Specifications, criteria, and guidelines provide a practical and logical approach to the protection problems. Protection against the indirect effects of lightning is intimately involved with the electromagnetic compatibility and electromagnetic interference functions. While this document does not deal specifically with electromagnetic compatibility and electromagnetic interference, it does deal with the interactions between lightning protection measures and measures employed for electromagnetic compatibility and control of electromagnetic interference. Author

N74-12501*# Goodrich (B. F.) Co., Akron, Ohio.
LIGHTWEIGHT TIRE CONCEPT FOR SPACE SHUTTLE Final Report
W. T. Shufflebotham 30 Oct. 1973 47 p

(Contract NAS9-12049)
(NASA-CR-134127; ATD-2751) Avail: NTIS HC $4.50 CSCL 22B

Various tests were conducted on a 49x17/26 PR aircraft tire that had been designed as a lightweight tire for use on the C-5A military transport. This tire is approximately 25 per cent lighter than a tire of the same size and ply rating that would be used in commercial airline service. The tires were tested at 40 per cent, 37 per cent, and 35 per cent deflections. These deflections were obtained by adjusting the inflation pressure while the load on the tire remained constant at 60,000 pounds. It was determined that the tire would operate successfully under the test conditions at 35% deflection. Prior to testing, the tires were subjected to conditions of high vacuum and low temperature. It was determined that the tires were not adversely affected by these conditions. Author

N74-12502*# Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.
STUDY OF A QUASI-MICROSCOPE DESIGN FOR PLANETARY LANDERS
Ouriel Giat and Earle B. Brown [1973] 39 p ref
(Contract NAS1-11918)
(NASA-CR-132315) Avail: NTIS HC $4.00 CSCL 22B

The Viking Lander fascimile camera, in its present form, provides for a minimum object distance of 1.9 meters, at which distance its resolution of 0.0007 radian provides an object resolution of 1.33 millimeters. It was deemed desirable, especially for follow-on Viking missions, to provide means for examing Martian terrain at resolutions considerably higher than that now provided. This led to the concept of quasi-microscope, an attachment to be used in conjunction with the fascimile camera to convert it to a low power microscope. The results are reported of an investigation to consider alternate optical configurations for the quasi-microscope and to develop optical designs for the selected system or systems. Initial requirements included consideration of object resolutions in the range of 2 to 50 micrometers, an available field of view of the order of 500 pixels, and no significant modifications to the fascimile camera. D.L.G.

N74-12503*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF INVESTIGATIONS ON A 0.015-SCALE MODEL 2A CONFIGURATION OF THE ROCKWELL INTERNATIONAL SPACE SHUTTLE ORBITER IN THE NASA/AMES RESEARCH CENTER 3.5 FOOT HYPERSONIC WIND TUNNEL
Morris D. Milam (Rockwell Inter.), Mark E. Nichols (Rockwell Inter.), and Jack A. Mellenthin (NASA. Ames Res. Center) Sep. 1973 174 p
(Contract NAS9-13247)
(NASA-CR-128786; DMS-DR-2044) Avail: NTIS HC $10.75 CSCL 22B

Experimental aerodynamic investigations were conducted in the NASA/Ames 3.5-Foot Hypersonic wind Tunnel during the interim April 9-18, 1973 on a 0.015-scale model of the Rockwell International Space Shuttle Orbiter, configuration 2A. Six component aerodynamic force and moment data were recorded over an angle of attack range from -3 deg to 42 deg at 0 deg angle of sideslip and from -10 deg to 10 deg sideslip at 0 deg and 45 deg constant angle of attack. Test Mach numbers were 5.27 and 7.32 at unit Reynolds number of 2.5 million per foot. Various elevon, rudder, speedbrake, and body flap deflections were tested to determine longitudinal and lateral-directional stability characteristics and to establish trim capability. Author

N74-12504*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MISSION SL-4 (AS 208/CM 118/IMU 34)G AND N ERROR ANALYSIS (SKYLAB 4)
S. B. Helfant Oct. 1973 33 p
(Contract NAS9-4065)
(NASA-CR-134131; E-2795) Avail: NTIS HC $3.75 CSCL 22C

Data on the gyro and navigation system performance and operation for the command module are presented. Each reported failure was analyzed with respect to its likelihood of occurrence in flight and its impact on the mission. Author

N74-12505*# Goodrich (B. F.) Co., Troy, Ohio. Wheel and Brake Plant.
ENGINEERING REPORT. PART 2: NASA WHEEL AND BRAKE MATERIAL TRADEOFF STUDY FOR SPACE SHUTTLE TYPE ENVIRONMENTAL REQUIREMENTS
L. D. Bok 8 May 1973 27 p refs
(Contract NAS9-12049)
(NASA-CR-134129; Rept-4239-Pt-2) Avail: NTIS HC $3.50 CSCL 22B

The study included material selection and trade-off for the structural components of the wheel and brake optimizing weight vs cost and feasibility for the space shuttle type application. Analytical methods were used to determine section thickness for various materials, and a table was constructed showing weight vs. cost trade-off. The wheel and brake were further optimized by considering design philosophies that deviate from standard aircraft specifications, and designs that best utilize the materials being considered. Author

N74-12506*# Goodrich (B. F.) Co., Troy, Ohio. Wheel and Brake Plant.
ENGINEERING REPORT. PART 3: NASA LIGHTWEIGHT WHEEL AND BRAKE SUB-SYSTEM. LIGHTWEIGHT BRAKE DEVELOPMENT
L. D. Bok 5 Oct. 1973 85 p refs
(Contract NAS9-12049)
(NASA-CR-134130; Rept-4239-Pt-3) Avail: NTIS HC $6.25 CSCL 22B

The development of light weight wheel and brake systems designed to meet the space shuttle type requirements was investigated. The study includes the use of carbon graphite composite and beryllium as heat sink materials and the compatibility of these heat sink materials with the other structural components of the wheel and brake. Author

N74-12507*# National Aeronautics and Space Administration, Washington, D.C.
THE APOLLO SPACECRAFT: A CHRONOLOGY. VOLUME 2: 8 NOVEMBER 1962 - 30 SEPTEMBER 1964
Mary Louise Morse and Jean Kernahan Bays 1973 290 p refs
(NASA-SP-4009) Avail: NTIS HC $6.50 CSCL 22B

A chronology of the Apollo spacecraft development and production program is presented. The subjects discussed are: (1) defining contractural relations, (2) developing hardware distinctions, and (3) developing software ground rules. Illustrations, drawings, and photographs are used extensively to supplement the technical writing. Descriptions of life support systems, communication equipment, propulsion systems, control devices, and spacecraft components are provided. Author

N74-12508*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SKYLAB 2 POST-LAUNCH REPORT (RCS 76-0000-00048)
21 Jun. 1973 74 p
(NASA-TM-X-69453) Avail: NTIS HC $5.75 CSCL 22C

The launch vehicle stages for SL-2, the CSM experiments, and their associated support equipment are reported. The performance of KSC systems in support of processing and launch of the SL-2 are described along with major processing events for each launch vehicle stage, the spacecraft, and the general experiments of the SL-2 S/V. The final countdown and hold times are noted and a summary of the launch vehicle is included. The weather conditions at launch time and the range support activities are given. Author

N74-12509*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS ON AN 0.030-SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS, VOLUME 1
R. H. Spangler (Rockwell Intern. Corp., Downey, Calif.) Oct. 1973 998 p
(Contract NAS9-13247)
(NASA-CR-128794-Vol-1; DMS-DR-2032-Vol-1) Avail: NTIS HC $52.00 CSCL 22B

Tests were conducted in unitary plan wind tunnels on an

0.030-scale replica of the space shuttle vehicle configuration 2A. Aerodynamic loads data were obtained at Mach numbers from 0.6 to 3.5. The investigation included tests on the integrated (launch) configuration and tests on the isolated orbiter (entry configuration). The integrated vehicle was tested at angles of attack and sideslip from minus 8 deg to plus 8 deg. The isolated orbiter was tested at angles of attack from minus 15 deg to plus 40 deg and angles of sideslip from minus 10 deg to plus 10 deg are dictated by trajectory considerations. The effects of orbiter/external tank incidence and deflected control surfaces on aerodynamic loads were also investigated. Author

N74-12510*# Chrysler Corp., New Orleans, La. Space Div.
PRESSURE LOADS AND AERODYNAMIC FORCE INFORMATION FOR THE -89A SPACE SHUTTLE ORBITER CONFIGURATION, VOLUME 2
R. C. Mennell (Rockwell Intern. Corp., Los Angeles, Calif.) Sep. 1973 697 p
(Contract NAS9-13247)
(NASA-CR-128758; DMS-DR-2021-Vol-1) Avail: NTIS HC $36.75 CSCL 22B

Experimental aerodynamic investigations were conducted on an 0.0405 scale representation of the Rockwell -89A Light Weight Space Shuttle Orbiter. The test purpose was to obtain pressure loads data in the presence of the ground for orbiter structural strength analysis. Aerodynamic force data was also recorded to allow correlation with all pressure loads information. Angles of attack from minus 3 deg to 18 deg and angles of sideslip of 0 deg, plus or minus 50 deg, and plus or minus 10 deg were tested in the presence of the NAAL ground plane. Static pressure bugs were used to obtain a pressure loads survey of the basic configuration, elevon deflections of 5 deg, 10 deg, 15 deg, and minus 20 deg and a rudder deflection of minus 15 deg, at a tunnel dynamic pressure of 40 psi. The test procedure was to locate a maximum of 30 static pressure bugs on the model surface at various locations calculated to prevent aerodynamic and physical interference. Then by various combinations of location the pressure bugs output was to define a complete pressure survey for the fuselages, wing, vertical tail, and main landing gear door. Author

N74-12511*# Chrysler Corp., New Orleans, La. Space Div.
WIND TUNNEL TEST OF THE 0.015-SCALE ROCKWELL INTERNATIONAL SPACE SHUTTLE VEHICLE ORBITER IN THE AMES 6 BY 6 FOOT SUPERSONIC WIND TUNNEL
M. D. Milam and T. J. Dziubala Oct. 1973 802 p ref
(Contract NAS9-13247)
(NASA-CR-128790; DMS-DR-2050) Avail: NTIS HC $42.25 CSCL 22B

Experimental investigations were performed in a 6- by 6-Foot Supersonic wind tunnel on a 0.015-scale model of the Rockwell International space shuttle vehicle (SSV) 2A orbiter. The purpose of the test was to investigate the longitudinal and lateral-directional characteristics of the vehicle. In addition, hinge moments were measured on the rudder and elevons. Buffet onset was investigated using wing trailing edge pressures and a strain gauge instrumented panel mounted in the wing. The model was tested through a Mach range from 0.6 to 2.0 at a constant unit Reynolds number of 2.5 million. Pitch runs were made at angles of attack from minus 2 deg to +26 deg with beta = 0 deg and 5 deg; yaw runs were made in the range from minus 5 deg to 10 deg of sideslip at angles of attack of 0 deg and 10 deg. Static pressures were measured at the fuselage base and the trailing edges of the wing and rudder. Boundary layer transition was fixed for some runs using distributed roughness strips. Author

N74-12512*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
RENDEZVOUS TERMINAL PHASE AUTOMATIC BRAKING SEQUENCING AND TARGETING
Peter M. Kachmar Jul. 1973 42 p Revised
(Contract NAS9-10268)
(NASA-CR-134152; Doc-15-Rev-2) Avail: NTIS HC $4.25 CSCL 22B

The purpose of the rendezvous terminal phase braking program is to provide the means of automatically bringing the primary orbiter within desired station keeping boundaries relative to the target satellite. A detailed discussion is presented on the braking program and its navigation, targeting, and guidance functions. Author

N74-12513*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
DEORBIT TARGETING
Wayne H. Tempelman Jun. 1973 26 p refs
(Contract NAS9-10268)
(NASA-CR-134151; Doc-14-Rev-1) Avail: NTIS HC $3.50 CSCL 22B

The navigation and control of the space shuttle during atmospheric entry are discussed. A functional flow diagram presenting the basic approach to the deobit targeting problem is presented. The major inputs to be considered are: (1) vehicle state vector, (2) landing site location, (3) entry interface parameters, (4) earliest desired time of landing, and (5) maximum cross range. Mathematical models of the navigational procedures based on controlled thrust times are developed. Author

N74-12514*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
RENDEZVOUS TARGETING
Wayne H. Tempelman Jul. 1973 59 p refs
(Contract NAS9-10268)
(NASA-CR-134150; Doc-7-Rev-3) Avail: NTIS HC $5.00 CSCL 22B

Revisions to be included in 'Space Shuttle Guidance, Navigation and Control Design Equations' are reported. Technical changes include: (1) a plane change maneuver was incorporated in the program's logic; (2) in the search for an apsidal crossing, program checks were included to update through intervals of pi in the case of near circular orbits or close proximity to an apsidal point; (3) following an astronaut overwrite of a Lambert maneuver, the state vector was updated to establish a new target vector for use in the powered flight routine; and (4) following the computation of each maneuver, the position vector of the primary vehicle was offset - to help compensate for the effects of the finite maneuver - prior to the update of the state vector to the next maneuver point. Input and output variables, detailed flow diagrams a functional flow diagram, and a description of equations are presented. Author

N74-12515*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
UNIFIED POWERED FLIGHT GUIDANCE
Timothy J. Brand, Dennis W. Brown, and John P. Higgins Jun. 1973 69 p refs
(Contract NAS9-10268; DSR Proj. 55-40800)
(NASA-CR-134149; Doc-24) Avail: NTIS HC $5.50 CSCL 22B

A complete revision of the orbiter powered flight guidance scheme is presented. A unified approach to powered flight guidance was taken to accommodate all phases of exo-atmospheric orbiter powered flight, from ascent through deorbit. The guidance scheme was changed from the previous modified version of the Lambert Aim Point Maneuver Mode used in Apollo to one that employs linear tangent guidance concepts. This document replaces the previous ascent phase equation document. Author

N74-12516*# Chrysler Corp., New Orleans, La. Space Div.
SUPERSONIC AERODYNAMIC CHARACTERISTICS ASSOCIATED WITH VARIATIONS IN THE GEOMETRY OF THE FORWARD PORTION OF IRREGULAR PLANFORM WINGS
Bernard Spencer, Jr. and David R. Stone Oct. 1973 167 p refs
(Contract NAS9-13247)
(NASA-CR-128791; DMS-DR-2052) Avail: NTIS HC $10.50 CSCL 22B

The experimental longitudinal and lateral-directional stability characteristics of a Langley conceptual space shuttle orbiter design have been obtained for a series of inboard planform fillets in a unitary plan wind tunnel. Fillet sweep angles up to 78 deg were investigated while holding the spanwise intersection of the fillet and wing constant. The data were obtained at Mach numbers of 2.36 to 4.63 and at Reynolds numbers (depending on Mach number) of 1.5 million to 2.5 million per foot. The angle of

attack was varied from about minus 2 deg to 44 deg at 0 deg and 3 deg of sideslip. Author

N74-12517*# Chrysler Corp., New Orleans, La. Space Div.
HYPERSONIC PERFORMANCE, STABILITY AND CONTROL CHARACTERISTICS OF A .0075 SCALE MODEL ROCKWELL INTERNATIONAL 089B-139B ORBITER CONFIGURATION
R. W. Powell (NASA. Langley Res. Center) and T. A. Blackstock (NASA. Langley Res. Center) Oct. 1973 105 p
(Contract NAS9-13247)
(NASA-CR-128783; DMS-DR-2066) Avail: NTIS HC $7.25 CSCL 22B

An investigation was made in the Langley Continuous Flow Hypersonic Tunnel at a Mach number of 10.3 to study the hypersonic aerodynamic characteristics of a Rockwell International shuttle orbiter configuration. Tests were made at a Reynolds number of 790,000 x 106 based on body length with an angle-of-attack range of 10 to 35 deg and sideslip variations of +1 to -9 deg. The effects of elevon and body flap deflection were investigated. Author

N74-12518*# Chrysler Corp., New Orleans, La.
STATIC STABILITY AND CONTROL EFFECTIVENESS OF MODELS 12-0 AND 34-0 OF THE VEHICLE 3 CONFIGURATION, VOLUME 3
E. C. Allen (Rockwell Intern. Corp., Huntsville, Ala.) and T. Tuttle (Rockwell Intern. Corp., Downey, Calif.) Oct. 1973 785 p
(Contract NAS9-13247)
(NASA-CR-128780-Vol-2; DMS-DR-2055-Vol-3) Avail: NTIS HC $41.25 CSCL 22B

Static stability and control effectiveness characteristics of two 0.004 scale models of the vehicle 3 configuration are reported. The components investigated consisted of a single aft body, vertical/rudder, OMS pods with two interchangeable wings, four interchangeable forward bodies, four trimmers, and a spoiler. The test was conducted in 14 x 14 inch trisonic wind tunnel over a Mach number range from 0.6 to 4.96. Angles of attack from 0 to 60 degrees and angles of sideslip from -10 to 10 degrees at 0, 10, 20,30, and 40 degrees angle of attack were tested. Elevon, body flap, and speed brake deflection composed the parametric considerations. No grit was placed on the models during the test. The tabulated source data and incremental data figures are presented. Author

N74-12519*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS ON AN 0.030-SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS, VOLUME 2
R. H. Spangler (Rockwell Intern. Corp., Downey, Calif.) Oct. 1973 1026 p
(Contract NAS9-13247)
(NASA-CR-128794; DMS-DR-2032-Vol-2) Avail: NTIS HC $52.50 CSCL 22B

Tests were conducted in Unitary Plan wind tunnels on a 0.30 scale model of the space shuttle. Tests were conducted on the integrated configuration and on the isolated orbiter. The integrated vehicle was tested at angles of attack and sideslip from minus 8 degrees to plus 8 degrees. The isolated orbiter was tested at angles of attack from minus 15 degrees to plus 40 degrees and angles of sideslip from minus 10 degrees to plus 10 degrees as dictated by trajectory considerations. The effects of orbiter/external tank incidence angle and deflected control surfaces on aerodynamic loads were investigated. Author

N74-12520*# McDonnell-Douglas Corp., St. Louis, Mo.
QUANTITATIVE UNDERSTANDING OF EXPLOSIVE STIMULUS TRANSFER Final Report
M. L. Schimmel Washington NASA Dec. 1973 45 p refs
(Contracts NAS1-9903; NAS1-10762)
(NASA-CR-2341) Avail: NTIS HC $3.00 CSCL 19A

The mechanisms of detonation transfer across hermetically sealed interfaces created by necessary interruptions in high explosive trains, such as at detonators to explosive columns, field joints in explosive columns, and components of munitions fuse trains are demostrated. Reliability of detonation transfer is limited by minimizing explosive quantities, the use of intensitive explosives for safety, and requirements to propagate across gaps and angles dictated by installation and production restraints. The major detonation transfer variables studied were: explosive quanity, sensitivity, and thickness, and the separation distances between donor and acceptor explosives. Author

N74-12521*# Fabric Research Labs., Inc., Dedham, Mass.
DEVELOPMENT OF FLAME-RESISTANT STRUCTURES FOR USE IN THE APOLLO AND SKYLAB PROGRAMS Final Report
Robert J. Coskren Sep. 1973 12 p
(Contract NAS9-12418)
(NASA-CR-134133) Avail: NTIS HC $3.00 CSCL 22B

Flame-resistant materials have been designed and fabricated to meet certain end-use criteria established by NASA with emphasis on meeting established flammability standards. The program had three general phases: (1) fabrication of candidate sample structures for evaluation by the Structures and Mechanics Division and/or NASA contractors; (2) physical testing of the structures developed; and (3) supply of required quantities of specific items for fabrication into prototype and/or flight items for the Apollo and Skylab programs. Author

N74-12522*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
HIGH TEMPERATURE ANTENNA DEVELOPMENT FOR SPACE SHUTTLE, VOLUME 1 Final Report
E. A. Kuhlman 30 Jul. 1973 333 p refs
(Contract NAS9-13004)
(NASA-CR-134136; MDC-E0896-Vol-1) Avail: NTIS HC $18.75 CSCL 22B

Design concepts for high temperature flush mounted Space Shuttle Orbiter antenna systems are discussed. The design concepts include antenna systems for VHF, L-band, S-band, C-band and Ku-band frequencies. The S-band antenna system design was completed and test hardware fabricated. It was then subjected to electrical and thermal testing to establish design requirements and determine reuse capabilities. The thermal tests consisted of applying ten high temperature cycles simulating the Orbiter entry heating environment in an arc tunnel plasma facility and observing the temperature distributions. Radiation pattern and impedance measurements before and after high temperature exposure were used to evaluated the antenna systems performance. Alternate window design concepts are considered. Layout drawings, supported by thermal and strength analyses, are given for each of the antenna system designs. The results of the electrical and thermal testing of the S-band antenna system are given. Author

N74-12523*# Chrysler Corp., New Orleans, La. Space Div.
STABILITY AND CONTROL CHARACTERISTICS OF A LANGLEY CONCEPT SPACE SHUTTLE ORBITER (LO-100) AT LOW SUBSONIC SPEEDS
Bernard Spencer, Jr. (NASA. Langley Res. Center) Oct. 1973 58 p refs
(Contract NAS9-13247)
(NASA-CR-128787; DMS-DR-2070) Avail: NTIS HC $5.00 CSCL 22B

An experimental aerodynamic investigation was conducted on a 0.01 scale model of a Langley concept space shuttle orbiter (LO-100) in the Langley Low Turbulence Pressure Tunnel at a Mach number of 0.25 and at a Reynolds number of 5.4 million per foot. The angle of attack was varied from about -2 deg to 24 deg at 0 deg and 5 deg sideslip. The configuration was tested at elevon settings of 0 deg, -5 deg, -10 deg, and -15 deg for a body base flap setting of 0 deg and at 0 deg, -10 deg, and -15 deg for a body base flap setting of -18 deg. The effect of rudder flare angle was obtained using 0 deg, 20 deg, and 40 deg, flare settings. Author

N74-12524*# Chrysler Corp., New Orleans, La. Data Management Services.
RESULTS OF TESTS IN THE MSFC 14 X 14 INCH TRISONIC WIND TUNNEL ON A .004 SCALE MODEL OF THE ROCKWELL INTERNATIONAL SPACE SHUTTLE VEHICLE 3, (INTEGRATED CONFIGURATION)
E. C. Allen (Rockwell Intern.) and Tom Hamiliton (Rockwell Intern.)

[1973] 330 p
(Contract NAS9-13247)
(NASA-CR-128788; DMS-DR-2063) Avail: NTIS HC $18.50 CSCL 22B

Experimental aerodynamic investigations were conducted during mid-July, 1973 on a .004 scale model of the Rockwell International integrated configuration Space Shuttle Vehicle 3. The purpose of the tests was three fold: (1) to determine the static stability characteristics of the integrated vehicle, utilizing the Vehicle 3 orbiter configuration; (2) to determine the effect of interstage structure and tank external fuel lines on the integrated vehicle aerodynamic characteristics; (3) to determine the effects of the aft interstage structure on orbiter aerodynamic loads. Data were recorded on the integrated vehicle (test no. 579) at angles of attack and sideslip ranging from -10 deg to 10 deg over a Mach number schedule from 0.6 to 4.96. Data were obtained on the orbiter alone in the presence of the external tank with SRB attached (test no. 580) at angles of attack from -10 deg to 10 deg over a Mach number range from .6 to 1.96. Plotted data are presented in the body axis system. Author

N74-12525*# Martin Marietta Corp., Denver, Colo.
ACQUISITION/EXPULSION SYSTEM FOR EARTH ORBITAL PROPULSION SYSTEM STUDY. VOLUME 1: SUMMARY REPORT Final Report
Oct. 1973 29 p refs
(Contract NAS9-12182)
(NASA-CR-134153; MCR-73-97-Vol-1) Avail: NTIS HC $3.50 CSCL 22B

Design, construction, and quality control tests on a dual screen liner device for the space shuttle orbiter cryogenic fuel tank and feedliner system are summarized. The dual stainless steel mesh of the device encloses eight liquid fuel channels and provides the liquid/vapor interface stability required for low gravity orbits. G.G.

N74-12526*# Martin Marietta Corp., Denver, Colo.
ACQUISITION/EXPULSION SYSTEM FOR EARTH ORBITAL PROPULSION SYSTEM STUDY. VOLUME 2: CRYOGENIC DESIGN Final Report
Oct. 1973 307 p refs
(Contract NAS9-12182)
(NASA-CR-134154; MCR-73-97-Vol-2) Avail: NTIS HC $17.50 CSCL 22B

Detailed designs were made for three earth orbital propulsion systems; (1) the space shuttle (integrated) OMS/RCS, (2) the space shuttle (dedicated) OMS (LO2), and (3) the space tug. The preferred designs from the integrated OMS/RCS were used as the basis for the flight test article design. A plan was prepared that outlines the steps, cost, and schedule required to complete the development of the prototype DSL tank and feedline (LH2 and LO2) systems. Ground testing of a subscale model using LH2 verified the expulsion characteristics of the preferred DSL designs. Author

N74-12527*# Martin Marietta Corp., Denver, Colo.
ACQUISITION/EXPULSION SYSTEM FOR EARTH ORBITAL PROPULSION SYSTEM STUDY. VOLUME 3: CRYOGENIC TEST Final Report
Oct. 1973 275 p refs
(Contract NAS9-12182)
(NASA-CR-134155; MCR-73-97-Vol-3) Avail: NTIS HC $15.75 CSCL 22B

A ground test program was conducted to verify several of the design methods and techniques that were used in designing cryogenic acquisition/expulsion systems. The testing of a 63.5-cm diameter DSL subscale model was particularly significant. Under these tests, the operational characteristics of the DSL concept were verified using LH2 and LN2. Demonstration of the gas free liquid expulsion characteristics was accomplished by expelling LH2 under -1 g using both GH2 and GHe pressurization. Loading of the acquisition/expulsion device was successfully accomplished using LH2 and LN2. The liquid free vapor venting performance of the model was limited because of the thermal stratification under the -1 g test conditions. Author

N74-12528*# Martin Marietta Corp., Denver, Colo.
ACQUISITION/EXPULSION SYSTEM FOR EARTH ORBITAL PROPULSION SYSTEM STUDY. VOLUME 4: FLIGHT TEST ARTICLE Final Report
Oct. 1973 192 p refs
(Contract NAS9-12182)
(NASA-CR-134156; MCR-73-97-Vol-4) Avail: NTIS HC $11.75 CSCL 22B

Two orbital test plans were prepared to verify one of the passive cryogenic storage tank/feedline candidate designs. One plan considered the orbital test article to be launched as a dedicated payload using an Atlas F burner launching configuration. The second plan proposed to launch the orbital test article as a secondary payload on the Titan E/Centaur proof flight. The secondary payload concept was pursued until January 1973, when work to build the hardware for this phase of the contract was terminated for lack of a sponsor for the flight. The dedicated payload launched on an Atlas F is described. Author

N74-12529*# Martin Marietta Corp., Denver, Colo.
ACQUISITION/EXPULSION SYSTEM FOR EARTH ORBITAL PROPULSION SYSTEM STUDY. VOLUME 5: EARTH STORABLE DESIGN Final Report
Oct. 1973 240 p refs
(Contract NAS9-12182)
(NASA-CR-134157; MCR-73-97-Vol-5) Avail: NTIS HC $14.00 CSCL 22B

A comprehensive analysis and parametric design effort was conducted under the earth-storable phase of the program. Passive Acquisition/expulsion system concepts were evaluated for a reusable Orbital Maneuvering System (OMS) application. The passive surface tension technique for providing gas free liquid on demand was superior to other propellant acquisition methods. Systems using fine mesh screens can provide the requisite stability and satisfy OMS mission requirements. Both fine mesh screen liner and trap systems were given detailed consideration in the parametric design, and trap systems were selected for this particular application. These systems are compatible with the 100- to 500-manned mission reuse requirements. Author

N74-12530*# General Dynamics/Convair, San Diego, Calif.
RCS JET-FLOW FIELD INTERACTION EFFECTS ON THE AERODYNAMICS OF THE SPACE SHUTTLE ORBITER Final Report, 30 Jun. 1972 - 9 Nov. 1973
J. R. Rausch and A. M. Roberge Nov. 1973 235 p refs
(Contract NAS9-13012)
(NASA-CR-134068; CASD-NAS73-020) Avail: NTIS HC $13.75 CSCL 22B

A study was conducted to determine the external effects caused by operation of the reaction control system during entry of the space shuttle orbiter. The effects of jet plume-external flow interactions were emphasized. Force data were obtained for the basic airframe characteristics plus induced effects when the reaction control system is operating. Resulting control amplification and/or coupling were derived and their effects on the aerodynamic stability and control of the orbiter and the reaction control system thrust were determined. Author

N74-12531*# General Electric Co., Houston, Tex. Space Div.
CREW INTERFACE SPECIFICATIONS DEVELOPMENT FUNCTIONS, PHASE 3A Final Report
John G. Carl 10 Oct. 1973 94 p refs
(Contract NAS9-13375)
(NASA-CR-134147) Avail: NTIS HC $6.75 CSCL 22B

The findings and data products developed during the crew interface specification study for inflight maintenance and stowage functions are presented. Guidelines are provided for improving the present progress of defining, controlling, and managing the flight crew requirements. The following data products were developed: (1) description of inflight maintenance management process, (2) specifications for inflight maintenance management requirements, and (3) suggested inflight maintenance data processing reports for logistics management. Author

N74-12532# TRW Systems Group, Redondo Beach, Calif.
SKYLAB PRESS REFERENCE: THIRD MISSION, NOVEMBER 1973 - JANUARY 1974
Nov. 1973 28 p refs
(TRW-143-73NK) Avail: NTIS HC $3.50

The objectives and functions of the third Skylab mission are

discussed. The components of the space station are described to show their use in performing the mission. The production of alloys in a weightless environment is one of the missions reported. Some of the systems which are analyzed are: (1) the orbital workshop solar array, (2) onboard data recording systems, (3) communications systems, and (4) control systems. Author

N74-12533# TRW Systems Group, Redondo Beach, Calif.
PIONEER TO JUPITER PRESS REFERENCE: FIRST ENCOUNTER, PIONEER 10, DECEMBER 1973
Dec. 1973 57 p refs
(TRW-107-73NK-NA) Avail: NTIS HC $5.00

The mission of the Pioneer 10 space probe is discussed. The systems and instruments installed in the probe are described. Drawings of the probe trajectory and the components of the probe are provided. The characteristics of the planet Jupiter are defined. The manner in which the information on the planet Jupiter is gathered and transmitted is analyzed. Author

N74-12534*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT-DETERMINED STABILITY AND CONTROL CHARACTERISTICS OF THE M2-F3 LIFTING BODY VEHICLE
Alex G. Sim Washington Dec. 1973 95 p refs
(NASA-TN-D-7511; H-791) Avail: NTIS HC $3.75 CSCL 22B

Flight data were obtained over a Mach number range from 0.4 to 1.55 and an angle-of-attack range from -2 deg to 16 deg. Lateral-directional and longitudinal derivatives, reaction control rocket effectiveness, and longitudinal trim information obtained from flight data and wind-tunnel predictions are compared. The effects of power, configuration change, and speed brake are discussed. Author

N74-12535*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL VALIDATION OF A LANDING-DYNAMICS COMPUTER PROGRAM FOR LEGGED SPACECRAFT LANDERS
John R. McGehee and Sandy M. Stubbs Washington Dec. 1973 73 p refs
(NASA-TN-D-7301; L-8726) Avail: NTIS HC $3.00 CSCL 22B

Validation of a landing-dynamics computer program has been accomplished by comparing analytical data with data from a limited experimental program. Agreement obtained established the subject landing-dynamics computer program as a reliable design tool for legged spacecraft landers. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N74-12536 Rensselaer Polytechnic Inst., Troy, N.Y.
ANALYSIS OF NON-LINEAR CONTACT PROBLEMS BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Francis Edward Kennedy, Jr. 1972 179 p
Avail: Univ. Microfilms Order No. 73-14206

Several problems of solid mechanics involving contact between two or more bodies were investigated using the finite element method of analysis. The materials of the contacting bodies were allowed to exhibit nonlinear behavior. This factor makes solution of the resulting nonlinear contact problems very difficult, if not impossible, using classical techniques. It is shown that the finite element method is a very powerful tool for analyzing this type of problem. Dissert. Abstr.

N74-12537 California Inst. of Tech., Pasadena.
BUCKLING OF IMPERFECT CIRCULAR CYLINDRICAL SHELLS Ph.D. Thesis
Prem Bhatia 1972 189 p
Avail: Univ. Microfilms Order No. 73-14302

The buckling of imperfect circular cylindrical shells under uniform axial compression was investigated. The imperfection considered is prismatic and is in the form of flat spots along the complete length of the shell. Two flat spot configurations were studied. In the first case, a single flat spot along the complete length of the shell is considered. Curved and flat panels join to form sharp corners at their common edges. Numerical results are presented to show the effect of the width of the flat spot, thickness ratio and length to radius ratio of the shell, on the buckling load of the shell. In the second case, the imperfection is in the form of two or more identical flat spots disturbed uniformly along the circumference of the shell. This analysis is valid for any any integral number of identical flat spots. Numerical results are presented for 2, 3, 4, 8-flat spots. Dissert. Abstr.

N74-12538 Ohio State Univ., Columbus.
STRESS CORROSION CRACKING IN GASEOUS AND AQUEOUS ENVIRONMENTS Ph.D. Thesis
George Earl Kerns 1973 450 p
Avail: Univ. Microfilms Order No. 73-18912

Crack velocities were measured, in both aqueous and gaseous environments, using pre-cracked specimens of a double cantilever beam geometry. Two low alloy, high strength steels (quenched and tempered condition) were investigated - D6AC and AISI 4335V. The test environments were an aqueous 3 1/2% sodium chloride solution, and the pure gaseous species H2, D2, H2S, Cl2, HBr, HCl, NH3, CH4, and C2H2. In the H2 gas environment, the crack velocity was measured as a function of strength level, applied stress intensity, and gas pressure. In the H2S environment, stress intensity and gas pressure effects were studied. For the aqueous and other gaseous, environments, the crack velocity was studied as a function of applied stress intensity. As crack growth environments, the gaseous species exhibited widely different behavior. Dissert. Abstr.

N74-12539 California Univ., Los Angeles.
MODAL ANALYSIS FOR LIAPUNOV STABILITY OF ROTATING ELASTIC BODIES Ph.D. Thesis
Andre Daniel Colin 1973 211 p
Avail: Univ. Microfilms Order No. 73-18621

The determination of the altitude stability of spinning elastic bodies is considered. A complete study of this problem requires in general two parallel investigations. In the first part, a modal analysis is accomplished for a class of special problems and finally, a derivation for literal attitude stability criteria for idealized spinning flexible spacecraft is performed. The modal analysis is accomplished for a class of structures idealized by beams or disks of small flexural rigidity. In the description of the flexible appendage, a continuous elastic model is used, and the vibrations in the direction of the spin axis are analyzed for a fully constrained base rotation. The study is specialized to the cases where the high spin rate is combined to the small flexural rigidity to produce a small parameter. The method of matched asymptotic expansions represents the general framework used in obtaining the solution for the several structures studied. Dissert. Abstr.

N74-12540 Illinois Univ., Urbana.
NONLINEAR LAYERED FINITE ELEMENT ANALYSIS OF REINFORCED CONCRETE PLATES AND SHELLS Ph.D. Thesis
Frank Roseman Hand, Jr. 1972 151 p
Avail: Univ. Microfilms Order No. 73-17228

A layered nonlinear finite element procedure for determining the load-deflection history up to failure of reinforced concrete plates and shells of constant thickness is presented. A twenty degree-of-freedom shallow shell layered finite element is used. The nonlinear finite element analysis progresses through the use of an iterative or step-by-step procedure with the nonlinearity being introduced only through the material properties. Even though a nonlinear analysis is performed, each iteration is treated as a linear problem. Geometric nonlinearities are not considered. Several numerical examples are presented to confirm the adequacy of the mathematical model and establish the validity of the assumed material properties. Additional numerical examples, both plates and shells, are presented to demonstrate the applicability and flexibility of the proposed incremental analysis. Dissert. Abstr.

N74-12541 Illinois Univ., Urbana.
THERMAL RESIDUAL STRESSES IN STEEL PLATES AS A RESULT OF A MOVING SOURCE OF HEAT Ph.D. Thesis
Otis Lee Potter 1973 211 p
Avail: Univ. Microfilms Order No. 73-17624

The aim was to establish a procedure to analytically predict the thermoelastoplastic strain and stress history in a large thin plate due to a moving source of heat. The residual stresses to be considered result from the plastic deformations that occur during welding and which remain when the plate cools to room ambient temperature. To illustrate the procedure two basic problems were solved: A closed form solution and a finite element solution for the elastoplastic stress-strain history in a semi-infinite strip caused by a moving plane source of heat; and a closed form solution and a finite element solution for the elastic stress-strain distribution in a thin infinite plate caused by a moving point source of heat. The rate formulation of the thermalelastoplastic problem is presented using a finite element model. The general constitutive relationships between the stress-strain, and temperature rates are derived from Prandtl-Reuss stress-strain relationships and von Mises yield-criteria. Dissert. Abstr.

N74-12542 Ohio State Univ., Columbus.
BUCKLING OF ELASTIC FIBERS IN A COMPOSITE PLATE WITH VISCOELASTIC MATRIX Ph.D. Thesis
Ting-tsai Tseng 1973 72 p
Avail: Univ. Microfilms Order No. 73-18959

This investigation is to provide an analysis of the internal buckling of the fibers in a viscoelastic composite plate. The possibility of the existence of time dependent buckling phenomena due to stress relaxation in the matrix is discussed. As a first approximation, the fiber is treated as an elastic column supported by a continuous distribution of discrete viscoelastic springs. An initial deviation from straightness of the fibers is included in the analysis. Linear material responses and small deflection theory is assumed throughout. The viscoelastic material properties are expressed in an exponential series form which makes it convenient to incorporate actual material behavior in the analysis. Eigenfunction expansions are used to reduce the governing equation to a set of linear ordinary differential equations. The instability conditions are then determined from the characteristics of the coefficients in these expansions. Dissert. Abstr.

N74-12543 Illinois Univ., Urbana.
SECTION AND NOTCH SIZE EFFECTS IN FATIGUE Ph.D. Thesis
David Thomas Raske 1972 126 p
Avail: Univ. Microfilms Order No. 73-17378

The influence of size effects on the fatigue strength of metals has been studied. These effects were separated into two categories: Size or scale effects associated with changes in section size or length when stress or strain gradients are absent, and size effects associated with geometrical stress concentrations that produce stress and strain gradients. The findings indicate that the effect of specimen size on fatigue strength when stress gradients are absent is volume controlled, and can be determined by a simple mathematical relation between fatigue strength and volume. In the presence of geometrical stress concentrations, size effects are controlled by a critical volume at the notch root and the severity of the stress or strain gradient. A means to determine the fatigue notch factor, was devised by identifying the zone of metal at the notch root which is thought to govern the fatigue process. Corrections were then developed for the effects of the stress gradient and critical volume in this zone. Dissert. Abstr.

N74-12544 Illinois Univ., Urbana.
ELASTIC STRESS ANALYSIS OF AN ADHESIVE LAP JOINT SUBJECTED TO TENSION, SHEAR FORCE AND BENDING MOMENTS Ph.D. Thesis
Murlidhar Hakumatrai Pahoja 1972 168 p
Avail: Univ. Microfilms Order No. 73-17349

A stress analysis of the lap joint is presented treating the problem as one of plane strain. The joint is subjected to a general loading, consisting of tension, shear force and bending moments. The variation in the material properties and thickness of the two adherends is considered. The displacement field in the adhesive layer is expressed in series form and the compatibility condition at the interface is used to express the displacement field in the adherends. The potential energy of the joint is calculated and minimized to obtain linear, ordinary differential equations and boundary conditions. The differential equations are solved on the computer. Photoelasticity is used to confirm the theory. Two specimens of lap joint using a 1/4 in. layer of a photoelastic plastic simulating the adhesive, are tested photoelastically. The agreement between the theoretical and the experimental results is found to be good. Dissert. Abstr.

N74-12545 Stanford Univ., Calif.
NONLINEAR BENDING AND TORSION OF ROTATING BEAMS WITH APPLICATION TO LINEAR STABILITY OF HINGELESS HELICOPTER ROTORS Ph.D. Thesis
Dewey Harper Hodges 1973 174 p
Avail: Univ. Microfilms Order No. 73-14908

Nonlinear partial differential equations of motion suitable for describing bending in two directions (flap and lead-lag) and torsion (pitch) of a rotating, cantilevered beam are established. These equations are applied to a hingeless helicopter rotor in hovering flight and used to determine the stability characteristics and practical significance of the nonlinear terms for motion near the equilibrium position. The analysis proceeds by first postulating a set of nonlinear strain-displacement relations for a pretwisted, nonuniform beam. After the strain energy, kinetic energy, and virtual work of the generalized external forces are formulated, the equations of motion and respective boundary conditions follow by virtue of Hamilton's principle. Nonlinear terms are retained on the basis of a systematic scheme for ordering terms. The results are presented for a wide range of practical hingeless rotor configurations in the form of root-locus plots, damping plots, and stability boundaries. Dissert. Abstr.

N74-12546*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ANALYSIS OF AXISYMMETRICAL VIBRATION OF A PARTIALLY LIQUID-FILLED ELASTIC SPHERE BY THE METHOD OF GREEN'S FUNCTION
Rudolph F. Glaser Washington Nov. 1973 28 p refs
(NASA-TN-D-7472; M-382) Avail: NTIS HC $3.00 CSCL 20K

The longitudinal dynamic behavior of launch vehicles is largely determined by their huge liquid propellant masses which are spring supported by the elastic tank walls. Throughout much of the powered flight time, these masses constitute a high percentage of the entire vehicle mass and, therefore, may dominate the fundamental modes of the vehicle. In this report, a spherical container is considered. The analysis is based on a Galerkin approach, in the course of which a second-order differential equation must be solved. The solution has been obtained by the method of Green's function. This method is favorable because it displays the manner in which the analysis can be extended to partially liquid-filled general shells of revolution. The computer programs currently available for partially liquid-filled propellant tanks are based on the finite element methods and result in analytical models having as many as several hundred degrees of freedom. The method applied in this report results in a model having less than 10 degrees of freedom as can be shown by numerical evaluation. Therefore, it will be possible to analyze propellant tanks using much less computer time with comparable accuracy. Author

N74-12547# National Bureau of Standards, Washington, D.C. Center for Building Technology.
STRUCTURAL DEFLECTIONS: A LITERATURE AND STATE-OF-THE-ART SURVEY
T. V. Galambos, P. L. Gould, M. K. Ravindra, H. Suryoutomo, and R. A. Crist Oct. 1973 105 p refs Sponsored by HUD Prepared in cooperation with Wash. Univ., St. Louis
(NBS Proj. 4618381)
(NBS-BSS-47) Avail: SOD HC $1.25 as C13.29/2:47

A literature survey and state-of-the-art study was compiled using 233 primary source documents, research papers, and texts. Over 800 documents were scanned to arrive at the primary source documents. The problem of structural deflections is discussed and reviewed in its component areas of static and dynamic deflections as related to forcing functions and structural characteristics. Also the interactions of major structural deflec-

tions with building structures subsystems and human occupants is reviewed. Emphasis is placed on serviceability limit states of deflections. Detailed comparisons of human response to structural vibrations are also made. The report is broad in scope and covers the areas of analysis, design and experimentation. Author

N74-12548# Central Electricity Generating Board, London (England). Information Services.
ULTRASONIC PROPERTIES AND ELASTIC MODULI OF STEELS; A SELECTIVE BILIOGRAPHY, 1949 - 1972
P. G. Williams, comp Sep. 1973 21 p refs
(CE-Bib-234) Avail: NTIS HC $3.25

The annotated bibliography presented contains 68 references to ultrasonic test and elastic moduli studies on steels. Nondestructive and holographic test methods were used for evaluations. G.G.

N74-12549# Central Electricity Generating Board, London (England). Information Services.
OVERHEAD LINE VIBRATIONS: A SELECTIVE BIBLIOGRAPHY, 1967 - OCTOBER 1972
P. G. Williams, comp. Aug. 1973 18 p refs
(CE-Bib-11B.2) Avail: NTIS HC $3.00

An annotated bibliography is presented concerning overhead line vibrations. An author index is included along with 75 references. K.M.M.

N74-12550# Aeronautical Research Labs., Melbourne (Australia).
A REVIEW OF STRESS INTENSITY FACTORS FOR SURFACE AND INTERNAL CRACKS
R. H. Keays Apr. 1973 46 p refs
(ARL/SM-Rept-343) Avail: NTIS HC $4.50

The mathematical basis is reviewed for the calculation of stress intensity factors for surface and internal cracks. The starting point is the known exact solution for an elliptical crack in an infinite elastic medium. Then the various correction factors which have been applied to this result to obtain stress intensity factors for surface cracks in plates of finite thickness are described. An account is also given of corrections used to allow for plasticity effects. The frequent occurrence of nearly elliptical cracks in practice is discussed, and brief mention is made of cracks having a non-elliptical shape. Author

N74-12551*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A FINITE ELEMENT FOR THERMAL STRESS ANALYSIS OF SHELLS OF REVOLUTION
Howard M. Adelman, Harold C. Lester, and James L. Rogers, Jr. Washington Dec. 1973 59 p refs
(NASA-TN-D-7286; L-8670) Avail: NTIS HC $3.50 CSCL 20K

A new finite element is described for performing detailed thermal stress analysis of thin orthotropic shells of revolution. The element provides for temperature loadings which may vary over the surface of the shell as well as through the thickness. In a number of sample calculations, results from the present method are compared with analytical solutions as well as with independent numerical analyses. Such calculations are carried out for two cylinders, a conical frustum, a truncated hemisphere, and an annular plate. Generally, the agreement between the present solution and the other solutions is excellent. Author

N74-12552# Hawaii Univ., Honolulu. Dept. of Mechanical Engineering.
BOOM FORCES IN LIBRATING DUMBELL-TYPE SATELLITES
Subhash Chandler Sharma (Calif. Univ., Santa Barbara) and Willem Stuiver 21 Nov. 1973 25 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in April 19-74
Avail: NTIS HC $3.25

The analysis and computation of boom forces in librating axisymmetrical satellites of dumbbell-type configuration are presented. Implicit expressions for the satellite boom force as a function of the libration state vector are derived from the equations of forced relative motion of the composite of the two boom end masses, together with those of satellite attitude motion. These expressions were used for the calculation of the time-varing boom force for given values of satellite inertia parameter, orbit eccentricity and initial kinetic energy of libration. Author

N74-12553# Hawaii Univ., Honolulu. Dept. of Mechanical Engineering.
PERIODIC BOOM FORCES IN DUMBELL-TYPE SATELLITES MOVING IN A CIRCULAR ORBIT
Iftikhar Saeed and Willem Stuiver 21 Nov. 1973 47 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Apr. 1974
Avail: NTIS HC $4.50

The analysis and computation are presented of the boom forces generated in axisymmetrical, dumbbell-type satellites when librating in a circular orbit. Dumbbell-type satellites are defined as satellites with a configuration composed of a dumbbell and a centerbody. Expressions for the boom force are obtained in terms of the angles of libration and their derivatives. Together with the equations of satellite attitude motion, these expressions determine the time-varying boom force occurring in libration. This boom force is calculated, for different values of the satellite inertia parameter, for some known cases of periodic libration of axisymmetrical satellites moving in a circular orbit. Author

N74-12554*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF HYDRAULIC-LINE RESONANCE AND ITS ATTENUATION
John L. Sewall, David A. Wineman, and Robert W. Herr Washington Dec. 1973 79 p refs
(NASA-TM-X-2787; L-8738) Avail: NTIS HC $3.75 CSCL 20K

An investigation of fluid resonance in high-pressure hydraulic lines has been made with two types of fluid dampers (or filters) installed in the line. One type involved the use of one or more closed-end tubes branching at right angles from a main line, and the other type was a fluid muffler installed in-line. These devices were evaluated in forced vibration tests with oscillatory disturbances over a 1000-Hz range applied to one end of the line and with oscillatory pressures measured at various stations along the main pipe. Limited applications of acoustic-wave theory to the branched systems are also included. Results show varying attenuations of pressure perturbations, depending on the number and location of branches and the type of muffler. Up to three branches were used in the branch-resonator study, and the largest frequency range with maximum attenuation was obtained for a three-branch configuration. The widest frequency ranges with significant attenuations were obtained with two types of fluid mufflers. Author

N74-12555*# Douglas Aircraft Co., Inc., Long Beach, Calif.
NON-CLASSICAL ADHESIVE-BONDED JOINTS IN PRACTICAL AEROSPACE CONSTRUCTION
L. J. Hart-Smith Jan. 1973 97 p refs
(Contract NAS1-11234)
(NASA-CR-112238) Avail: NTIS HC $47.00 CSCL 20K

Solutions are derived for adhesive-bonded joints of non-classical geometries. Particular attention is given to bonded doublers and to selective reinforcement by unidirectional composites. Non-dimensionalized charts are presented for the efficiency limit imposed on the skin as the result of the eccentricity in the load path through the doubler. It is desirable to employ a relativly large doubler to minimize the effective eccentricity in the load path. The transfer stresses associated with selective reinforcement of metal structures by advanced composites are analyzed. Reinforcement of bolt holes in composites by bonded metal doublers is covered quantitatively. Also included is the adhesive joint analysis for shear flow in a multi-cell torque box, in which the bond on one angle becomes more critical sooner than those on the others, thereby restricting the strength to less than the total of each maximum strength when acting alone. Adhesive plasticity and adherend stiffness and thermal imbalances are included. A simple analysis/design technique of solution in terms of upper and lower bounds on an all-plastic adhesive analysis is introduced. Author

N74-12556# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

FINITE DIFFERENCE FORMULATION FOR THE BOUNDARY REGIONS OF ORTHOTROPIC PLATES AND ITS APPLICATION TO THE PREDICTION OF THEIR DYNAMIC CHARACTERISTICS

G. Aksu and R. Ali Sep. 1973 31 p refs
(TT-7310) Avail: NTIS HC $3.75

A research program concerning The analysis of dynamic characteristics of automotive structures was conducted. A semimonocoque body structure mainly consists of an assembly of thin plates which being cold rolled are anisotropic by nature. Moreover in places these plates have swage patterns impressed on them which also affects their directional elastic properties. Use of finite difference technique for the prediction of dynamic characteristics of plates has definite advantages in that the analysis retains desired features and results in reduced core storage and computing time requirements. If unequal interval formulation is utilized as has been done in this work, although the resulting matrices are unsymmetric further reduction in core storage requirement is achieved. Author

N74-12557# Central Electricity Generating Board, London (England).
WIND PRESSURES ON TALL STRUCTURES, 1962 - 1973

R. W. Prior Nov. 1973 24 p refs
(CE-Bib-119A.1) Avail: NTIS HC $3.25

A bibliography is presented of 131 studies concerning wind effects on buildings and structures. F.O.S.

N74-12558# Sandia Labs., Albuquerque, N.Mex.
SLADE D: A COMPUTER PROGRAM FOR THE DYNAMIC ANALYSIS OF THIN SHELLS

S. W. Key and Z. E. Beisinger Jan. 1973 155 p refs Sponsored by AEC
(SLA-73-79) Avail: NTIS HC $3.00

A finite-element-method FORTRAN program designed for the dynamic analysis of thin shells is presented. A doubly curved, arbitrary quadrilateral element is utilized. The element is based on a minimum potential energy principle for thin shells. A simple central difference time integration scheme together with a diagonal mass matrix is used to compute the transient dynamic response. Since the majority of aerospace structures are based on shells of revolution, the program is designed specifically for a shell the reference surface of which is a portion of an axisymmetric surface. The program allows up to five separate layers and up to five separate elastic anisotropic materials with temperature-dependent properties. The program handles variable thickness shells and allows thickness discontinuities along element boundaries. It provides for both normal and tangential surface loads and for temperature changes through the thickness as well as varying temperatures over the reference surface.
Author (NSA)

N74-12559# California Univ., Livermore. Lawrence Livermore Lab.
MODEL RELATING STRESS, STRAIN, STRAIN RATE, AND TEMPERATURE WITH AN EXPERIMENTAL DATA FIT FOR A URANIUM 7.5 PERCENT NIOBIUM 2.5 PERCENT ZIRCONIUM ALLOY

D. E. Lord 24 Apr. 1973 18 p refs
(Contract W-7405-eng-48)
(UCID-16254) Avail: NTIS HC $3.00

Theoretical results obtained with a model developed as a result of a strain energy-to-failure investigation agreed well with experimental results from a previous extensive strain rate and temperature excursion investigation of properties of a uranium 7.5% niobium-2.5% zirconium alloy. A relationship was established between strain rate and temperature over rather wide ranges, including a phase change, for this alloy, and a softening-point correlation for it was also established. The model seems to be readily extrapolative to other materials. Author (NSA)

N74-12560# California Univ., Livermore. Lawrence Livermore Lab.
PROPOSED MODEL RELATING STRESS, STRAIN, STRAIN RATE, AND STRAIN ENERGY

D. E. Lord 24 Apr. 1973 39 p refs
(Contract W-7405-eng-48)
(UCID-16253) Avail: NTIS HC $4.00

The study of high rate behavior of materials from an energy standpoint has led to a workable model relating stress, strain, strain rate, and strain energy. The original study encompassed extremes in strain rates, from very high to very low. Three separate sources, radiation deposition, gas-driven rams or projectiles, and conventional testing machines, were used. Data from the three sources was correlated and the behavior of selected materials ranging from brittle to very ductile suggested the model. The model was then verified by testing additional materials at various strain rates. Author (NSA)

N74-12561# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
PREDICTION OF CRITICAL CONDITIONS FOR FAILURE IN Zr - 2.5 PERCENT Nb PRESSURE TUBES BY THE COD CRITERION

B. Henry Jun. 1973 31 p refs In FRENCH
(EUR-5017) Avail: AEC Depository Libraries HC $3.75

Opening displacement measurements made during pressurization to failure of longitudinally cracked ID 92 mm, 2.7- to 3-mm-thick tube sections in Zr-2.5% Nb alloy allowed one to check the Strip yield model based correlation, proposed by Burdekin and Stone, corrected by the Folias factor for the bending effects on the crack flanks. Moreover, the critical conditions for failure of the tube sections (critical COD and tangential stress) were compared to those predicted by the combination of the above correlation and the critical COD values measured on small SEN specimens. The same check was done on hydrided specimens and one hydrided tube section. It is considered that the critical crack length of these pressure tubes may be predicted with a precision of about 30% on the basis of the COD sub-scale test, sufficient to a correct application of the leak-before-break criterion. Author (NSA)

N74-12562# Scientific Translation Service, Ann Arbor, Mich.
SPECIFIC CHARACTERISTICS OF CRACK PROPAGATION DURING CYCLIC LOADING IN LIQUID MEDIA

O. N. Romanov, Yu. D. Petrina, and Yu. V. Zima [1973] 7 p refs Transl. into ENGLISH from Fiz.-Khim. Mekhan. Materialov, Akad. Nauk Ukr. SSR (Kiev), v. 8, no. 4, 1972 p 35-38 Prepared for ORNL
(ORNL-tr-2692) Avail: NTIS HC $3.00

The effects of various media (air, oil, water 3% oleic acid in mineral oil) were studied at 300, 400, and 550 C for high strength 50 CrNi steel. The number of cycles necessary to form a circular crack 1 mm deep was measured, and the effects of cold work and aging were estimated from the ultimate strength in air. Microstructure and fracture structure are discussed. NSA

N74-12563# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
USING EXISTING DATA FOR COMPONENT DESIGN CONSIDERING CREEP-FATIGUE INTERACTION

A. L. Snow 1972 45 p refs Presented at Fall Meeting of the Soc. of Exptl. Stress Analysis, Seattle, 10-16 Oct. 1972
(Contract AT(45-1)-2171)
(Conf-721012-3) Avail: NTIS HC $4.25

The Fast Flux Test Facility is first reactor system designed per the rules of Code Case 1331-5 of the ASME Code. The 1050 F design temperature places the 304 and 316 austenitic stainless steel components into the creep domain. Applications of structural analysis, including creep and plasticity effects, are presented. Problems and future needs are discussed.
Author (NSA)

N74-12564# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
ESTIMATION OF STRUCTURAL STRENGTH UNDER COMBINED CYCLIC LOAD [ABSCHAETZUNG DER BAUTEILFESTIGKEIT BEI ZUSAMMENGESETZTER SCHWINGBEANSPRUCHUNG]

O. Svenson and W. Lipp Duesseldorf Betriebsforschungsinst. 1972 30 p refs In GERMAN
(LBF-FB-101/72; BFI-160) Avail: NTIS HC $3.50

A random operating load was simulated by consecutive cyclic stresses with constant amplitudes and frequencies. From the results on steel 41/chromium 4 bar probes stress cycle/lifetime diagrams were made. The lifetime curves were used in damage

calculations for estimating tolerable stresses for randomly composed cyclic stresses. The calculated tolerable stresses were never more than 11% higher than the experimental ones. Preliminary results on steel 37 bars indicated that the material used for the probes has no great influence on test results.
ESRO

N74-12565# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
INGA: INTERACTIVE GRAPHICAL ANALYSIS. USER MANUAL [INGA. INTERAKTIVE GRAPHISCHE ANALYSE. BENUTZERHANDBUCH]
Ingolf Grieger 12 Jan. 1973 133 p refs In GERMAN
(ISD-135) Avail: NTIS HC $8.75

A manual for using an interactive computer graphics system of structural analysis is presented. This interactive program system is intended to meet the needs of users in the field of static and dynamic structural analysis. The interactive system has been developed according to the modular principle and the main parts have been programmed in FORTRAN. The system operations are described, and some examples of their utilization are given.
ESRO

N74-12566# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
FINITE ELEMENTS FOR CALCULATION OF PRESTRESSED CONCRETE REACTOR PRESSURE VESSELS [FINITE ELEMENTE ZUR BERECHNUNG VON SPANNBETON-REAKTORDRUCKBEHAELTERN]
J. H. Argyris, G. Faust, J. R. Roy, J. Szimmat, E. P. Warnke, and K. J. William Apr. 1973 191 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. Fuer Forsch. und Technol.
(ISD-137) Avail: NTIS HC $11.75

The finite element theory, associated software design concepts, and the application of a program system for the analysis of prestressed concrete reactor vessels, are considered. Some of the basic concepts of the basic concepts of the finite element method, with regard to the analysis of three-dimensional composite solids, are reviewed. Different finite elements for idealization of various structural components in a prestressed concrete reactor vessel are discussed. The program and data organization are described, and a summary of the Choleski equation solver using hypermatrices and substructures is given. The capabilities of the program for the solution of technical problems are illustrated by a number of examples, including an extensive study of the THTR 1:5 scale pressure vessel model.
ESRO

N74-12567# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
CALCULATION OF STRESS CONCENTRATIONS ON SUPPORT STRUCTURES UNDER THERMO-MECHANICAL LOADING [BERECHNUNG VON SPANNUNGSKONZENTRATIONEN AN TRAGWERKEN UNTER THERMO-MECHANISCHER BELASTUNG]
John H. Argyris, Ingolf Grieger, and Guenter Wagemann 1973 29 p refs In GERMAN Presented at the 7th Colloq. on Schweisstech., Essen, 23 Mar. 1973
(ISD-143) Avail: NTIS HC $3.50

The finite element method was used for theoretical load and temperature distribution calculations. The advantage of this method for solvisg partial problems in shown. In many cases it is possible to deal with nonstationary problems. The method was applied on stress concentration calculations on a train wheel. Computer graphics were used to evaluate the results. ESRO

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N74-12568 Yale Univ., New Haven, Conn.
THERMAL CONVECTION IN A ROTATING, THIN SPHERICAL ANNULUS OF FLUID Ph.D. Thesis
William Bailey Heard 1972 120 p
Avail: Univ. Microfilms Order No. 73-14338

The results are presented of an analytical study of thermal convection in a Boussinesq fluid which is confined to a rotating spherical annulus. The fluid motions are driven by a negative temperature gradient imposed across the annulus. The fluid motions are driven by a negative temperature gradient imposed across the annulus. Idealized models of the fluid dynamical system are studied which are distinguished by their treatment of the interaction of the coriolis force and the buoyancy force. The inclined plane model consists of a rotating, plane layer of fluid in a uniform gravitational field acting normal to the layer such that the direction of the angular velocity is not restricted to be parallel to the gravitational force. The layer is regarded as a local approximation to a thin annulus. The equatorial, thin annulus model restricts attention to the equatorial region of the annulus. This region is the most unstable because inhibition of convection by rotation is least effective there. Dissert. Abstr.

N74-12569*# Alabama Univ., Huntsville.
THERMAL ENGINEERING RESEARCH Final Report
Cornelius C. Shih May 1973 93 p refs Sponsored by NASA
(NASA-CR-124481; UAH-146) Avail: NTIS HC $6.75 CSCL 20M

A theoretical investigation of gas flow inside a multilayer insulation system has been made for the case of the broadside pumping process. A set of simultaneous first-order differential equations for the temperature and pressure of the gas mixture was obtained by considering the diffusion mechanism of the gas molecules through the perforations on the insulation layers. A modified Runge-Kutta method was used for numerical experiment. The numerical stability problem was investigated. It has been shown that when the relaxation time is small compared with the time period over which the gas properties change appreciably, the set of differential equations can be replaced by a set of algebraic equations for solution. Numerical examples were given, and comparisons with experimental data were made. Author

N74-12570# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
THE CALCULATION OF COMBUSTOR-WALL TEMPERATURE DOWNSTREAM OF TOTAL-HEAD COOLING RINGS
A. K. Rastogi and J. H. Whitelaw Jan. 1973 27 p refs
(HTS/73/38) Avail: NTIS HC $3.50

Measurement of heat-transfer coefficient and adiabatic-wall effectiveness are reported downstream of three film-cooling rings, each with a different arrangement of total-head holes. These results are compared with predictions based on the finite-difference solution of appropriate three-dimensional conservation equations. The comparison shows that the prediction procedure reproduces the Nusselt number trends indicated by the experiments and that the maximum discrepancy between the two is less than 25%. The procedure was used to predict the influence of velocity ratio, density ratio, lip thickness, initial boundary-large thickness, and pitch to diameter ratio on the local Nusselt number for ranges of these variables of significance to gas-turbine combustion-chamber practice; the results confirm that only velocity ratio, density ratio, and lip thickness have a significant influence. The prediction procedure was used to calculate the hot-side convective component of the energy balance appropriate to a cooling ring in a gas-turbine combustion chamber. Author

N74-12571*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPONTANEOUS IGNITION IN AFTERBURNER SEGMENT TESTS AT AN INLET TEMPERATURE OF 1240 K AND A PRESSURE OF 1 ATMOSPHERE WITH ASTM JET-A FUEL
Donald F. Schultz and J. Robert Branstetter Washington Dec. 1973 22 p refs
(NASA-TM-X-2952; E-7560) Avail: NTIS HC $2.75 CSCL 20M

A brief testing program was undertaken to determine if spontaneous ignition and stable combustion could be obtained

in a jet engine afterburning operating with an inlet temperature of 1240 K and a pressure of 1 atmosphere with ASTM Jet-A fuel. Spontaneous ignition with 100-percent combustion efficiency and stable burning was obtained using water-cooled fuel spraybars as flameholders. Author

N74-12572*# Scientific Translation Service, Santa Barbara, Calif.
HEAT TRANSFER OF A DISK ROTATING IN A CASING
V. M. Kapinos Washington NASA 3 Dec. 1973 18 p refs Transl. into ENGLISH from Aviats. Tekhn. (USSR), v. 8, no. 2, 1965 p 76-86
(Contract NASw-2483)
(NASA-TT-F-15199) Avail: NTIS HC $3.00 CSCL 20M

A discussion is given of the heat transfer between a heated rotating disk and a cooling fluid flowing radially from the center to the periphery in the gap between between the disk and the casing of a gas turbine (with cooled rotors). The heat transfer coefficient is determined making use of the Reynolds analogy. Author

N74-12573*# Scientific Translation Service, Santa Barbara, Calif.
INVESTIGATION OF HEAT TRANSFER FOR TWO VERSIONS OF TURBINE DISK COOLING
V. I. Devyatov Washington NASA 3 Dec. 1973 16 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats, Tekh. (Kazan), v. 8, no. 2, 1965 p 56-64
(Contract NASw-2483)
(NASA-TT-F-15206) Avail: NTIS HC $3.00 CSCL 20M

Experimental investigation of the heat transfer coefficients for two types of air-cooled disks: one, termed intermediate jet cooling, and one termed peripheral jet cooling. The temperature variation along the disk radius is shown in graphs as a function of rpm and Reynolds number. For Reynolds numbers ranging from 3.68 to 9.8 x 10 to the 5th power (rpm from 1500 to 4000) it is found that in the zone of the impinging jets upon the disk there is a region of high values of the heat transfer coefficient, and that at small Reynolds numbers, an increase in the height to length radio leads to a pronounced increase of cooling efficiency. The effectiveness of peripheral jet cooling decreases with increasing Reynolds number, and the method loses its advantages over the intermediate method of cooling. Author

N74-12574# National Aviation Facilities Experimental Center, Atlantic City, N.J.
THE INFLUENCE OF ENGINE-DUCTED BY-PASS AIR ON A BURNER-CAN BURN-THROUGH FLAME Final Report, May - Jul. 1973
Richard Hill Nov. 1973 26 p refs
(FAA Proj. 181-522-010)
(FAA-NA-73-87; FAA-RD-73-155) Avail: NTIS HC $3.50

The effect is determined of by-pass air flow on a burner-can burn-through flame. A simulator was developed to produce a burn-through flame external of a J-57 en-ine. Bleed-air from a J-57 was ducted and used as by-pass air during testing. Temperatures of the outer duct wall were monitored. A large decrease in temperature was noted with air flow through the by-pass duct. Author

N74-12575*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMODYNAMIC AND TRANSPORT PROPERTIES OF AIR AND ITS PRODUCTS OF COMBUSTION WITH ASTMA-A-1 FUEL AND NATURAL GAS AT 20, 30, AND 40 ATMOSPHERES
David J. Poferl and Roger A. Svehla Washington Dec. 1973 59 p refs
(NASA-TN-D-7488; E-7523) Avail: NTIS HC $3.50 CSCL 20M

The isentropic exponent, molecular weight, viscosity, specific heat at constant pressure, thermal conductivity, Prandtl number, and enthalpy were calculated for air, the combustion products of ASTM-A-1 jet fuel and air, and the combustion products of natural gas and air. The properties were calculated over a temperature range from 300 to 2800 K in 100 K increments and for pressures of 20, 30 and 40 atmospheres. The data for natural gas and ASTM-A-1 were calculated for fuel-air ratios from zero to stoichiometric in 0.01 increments. Author

N74-12576*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF TRANSIENT HEAT FLOW TO THICK-WALLED PLATES AND CYLINDERS
W. B. Powell 1 Dec. 1973 73 p refs
(Contract NAS7-100)
(NASA-CR-136226; JPL-TR-32-1588) Avail: NTIS HC $5.75 CSCL 20M

A methodology is described for the analysis of a transient temperature measurement made in a flat or curved plate subjected to convective heat transfer, such that the surface heat flux, the hot-gas temperture, and the gas heat transfer coefficient can be determined. It is shown that if the transient temperature measurement is made at a particular point located nearly midway in the thickness of the plate there is an important simplification in the data analysis process, in that the factor relating the surface heat flux to the measured rate of rise of temperature becomes invariant for a Fourier Number above 0.60 and for all values of the Biot Number. Parameters are derived, tabulated, and plotted which enable straightforward determination of the surface heat flux, the hot-gas temperature, of the plate, the rate of rise of temperature, the plate thickness and curvature, and the mean thermal properties of the plate material at the test temperature. Author

N74-12577# Oak Ridge National Lab., Tenn.
SECOND ITERATION ANALYSIS OF A FOSSIL FUEL-FIRED GAS TURBINE-POTASSIUM-STEAM COMBINED CYCLE
M. E. Lackey Jul. 1973 32 p refs
(Contract W-7405-eng-26)
(ORNL-NSF-EP-39) Avail: NTIS HC $3.75

The operating conditions and heat balance of the fossil fuel-fired potassium vapor topping cycle as proposed in an initial ORNL study carried out under the NSF-RANN program have been reexamined in considerable detail. It appears desirable to reduce the peak temperature in the steam system as well as make a number of modifications in the feed heating system. Gas turbine operating experience has been reviewed to provide a firm basis for choosing the turbine inlet temperature and component efficiency for the gas turbine cycle. On the basis of these analyses the operating conditions of the initial study were modified and a new flow sheet and heat balance were prepared using the supercritical pressure steam cycle of the TVA Bull Run steam plant as the point of departure. This gave an overall combined cycle efficiency of 52% and a net heat rate of 6580 Btu/kW-hr. Author (NSA)

N74-12578# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
HEAT TRANSFER IN TWO-PHASE LIQUID-GAS FLOWS
R. Semeria Feb. 1973 75 p refs In FRENCH
(CEA-N-1642) Avail: AEC Depository Libraries HC $5.75

Heat transfer in liquid-gas flows is reviewed, particular attention being given to problems involving phase changes. The following points are considered: interphase thermal resistance, interphase heat exchange without mass transfer, transfer between a wall and a two-phase fluid, nucleation, pool boiling, boiling in heated tubes, and condensation. NSA

N74-12579# Oxford Univ. (England). Lab. of Cryogenics.
HEPROP: A COMPUTER PROGRAMME FOR THE THERMOPHYSICAL PROPERTIES OF HELIUM
B. A. Hands 29 May 1973 101 p refs
(Rept-1046/72) Avail: NTIS HC $7.25

The HEPROP is a set of subprograms used to calculate the thermophysical properties of helium. The thermodynamic properties are derived from an equation of state, which is valid from about 2 K to 1700 K, and up to about 10 to the 8th power/sq m. By analytical differentiation and integration, pressure, enthalpy, and entropy are calculated as a function of density and temperature. Equations are provided for pressure, liquid density, and vapor density at saturation, thus enabling saturation properties to be calculated. In addition, programs were written for the velocity of sound and the Joule-Thomson coefficient using standard thermodynamic relationships. Equations for surface

tension, viscosity, thermal conductivity, refractive index, and dielectric constant are also included. Author (ESRO)

N74-12679* Auburn Univ., Ala.
SOLAR HEATING AND COOLING BUILDINGS
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 28 p refs (For availability see N74-12674 03-34)
CSCL 20M

N74-12684* Auburn Univ., Ala.
MARKET POTENTIAL FOR SOLAR HEATING AND COOLING IN BUILDINGS
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 13 p refs (For availability see N74-12674 03-34)
CSCL 20M

N74-12685* Auburn Univ., Ala.
STRATEGY FOR SOLAR HEATING AND COOLING IN BUILDINGS
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 159 p refs (For availability see N74-12674 03-34)
CSCL 20M

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N74-12580 Western Electronic Show and Convention, Los Angeles, Calif.
THE 1973 WESCON TECHNICAL PAPERS, VOLUME 17
1973 464 p refs Presented at Western Electron. Show and Conv., San Francisco, 11-14 Sep. 1973
Copyright. Avail: Western Periodicals Co., 13000 Raymer Street, North Hollywood, Calif. 91605

Manufacturing technology and marketing aspects of electronic equipment are considered. Data processing systems and mathematical modelling for engineering design criteria, quality control, and management procedures are emphasized. For individual titles, see N74-12581 through N74-12663.

N74-12581 Entrepreneur Press, Santa Clara, Calif.
EVALUATING THE MARKETPLACE
Donald M. Dible *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 3 p refs (For availability see N74-12580 03-34)
Copyright.

Evaluating the marketplace on a modest budget need not be as difficult as it may seem. Many of the options available to the marketeer for securing marketing information from sources other than the records of his own corporation are considered. Author

N74-12582 Drossler Research Corp., San Francisco, Calif.
HOW TO PLAN MARKETING STRATEGY
Richard A. Drossler *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

An integrated marketing strategy can be a strong competitive advantage by guiding tactical decisions toward a common goal. Suggested are five analytical steps to help develop a powerful competitive marketing strategy. A case history utilizing this approach is presented in a buying business models. Author

N74-12583 Fairchild Camera and Instrument Corp., Mountain View, Calif.
SUCCESSFUL MARKETING AND NEW PRODUCT INTRODUCTION
Frederick M. Hoar *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 3 p (For availability see N74-12580 03-34)
Copyright.

The proper techniques for announcing a new product in the electronics industry encompass press conferences for highest priority products, mailing of news releases, accompanied by photos, to various publications and trade magazines, and advertising strategies that give the product the deserved publicity. G.G.

N74-12584 Electronic Representatives Association, San Carlos, Calif.
BUILDING AND MOTIVATING A MANUFACTURER'S REP ORGANIZATION
Frank Lebell *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 1 p (For availability see N74-12580 03-34)
Copyright.

Representating manufacturers in a self-employed selling capacity-commonly termed rep necessitates functioning as management. Repping calls for being appointed to sell the product lines of various manufacturers according to certain negotiated conditions. The basic and most difficult part of being a rep is the acquisition of suitable lines. In order to acquire suitable lines, one should advertise oneself in trade publications; study ads by manufacturers requiring reps; and attend trade shows, which are excellent sources for obtaining lines. Author

N74-12585 Stanford Research Inst., Menlo Park, Calif.
THE POINT-OF-SALE MARKET
Alan Purchase *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 3 p (For availability see N74-12580 03-34)
Copyright.

The point-of-sale, or POS market, is considered. In providing perspectives on this market, some thoughts on products and services that various organizations could supply are outlined, and parts of this market that are best left to organizations with the tremendous financial, technical, and marketing resources are indicated. It would be more accurate to refer to these systems as inventory control systems, or sales accounting systems, or credit authorization systems that are really data systems for the retail sales industry. One of the data entry points for this retail sales data system is located where the sales transaction takes place. Author

N74-12586 American Regitel Corp., Sudbury, Mass.
POINT-OF-SALE: AN IDEA BECOMES AN INDUSTRY
Brian H. Clayton *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

A brief history of the development of the point-of-sale industry is given. Early systems were determined by the background of the designers, and by what was technically possible, more than by the needs of the retailers or what was economically justifiable. As the market has matured, economics has become paramount, and today there is less differentiation between the systems, and considerably more payoff to the user. Author

N74-12587 Safeway Stores, Inc., Oakland, Calif. Operations Service Div.
SYSTEMS DESIGN OPPORTUNITIES
Frederick N. Timm, III *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

The opportunities available to the systems designers in the fast growing and dynamic area of point-of-sale equipment have obligations which should be seriously observed by any company entering this field. The size of investment required by the retailers who install point-of-sale systems is substantial and when the mistakes and glamour of the initial installations wear off, the design should be capable of supporting the extras and promises originally provided. Author

N74-12588 California Univ., Berkeley.
ELECTRONIC INSTRUMENTATION FOR BLOOD FLOW MEASUREMENT AND TISSUE ANALYSIS c05
J. R. Singer IN WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs (For availability see N74-12580 03-34)
(Grants FR-7006; ASC-IN87P)
Copyright.

The important medical problems of blood flow and cancer diagnoses lend themselves to measurements by nuclear magnetic resonance (NMR) methods. The various means of utilizing NMR for blood flow measurements are described. Differences between normal and malignant tissues can also be measured using NMR. Author

N74-12589 Stanford Univ., Calif. Dept. of Electrical Engineering.
INTEGRATED CIRCUITS FOR AN IMPLANTABLE BLOOD FLOWMETER **c05**
David M. DiPietro (Hewlett-Packard Co., Santa Clara, Calif.) and James D. Meindl *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
(Contract N00014-67-A-0112-0044; Grant GM-17940-02)
Copyright.

An implantable telemetry system for measuring instantaneous pulsatile blood flow in the major arteries of animals has been developed. The device provides a new and necessary tool for accurate quantitative measurements in the study of cardiovascular disease. It has been used in studies of heart rejection and renal function to monitor blood velocity in the major arteries of dogs. The key to achieving this flowmeter is a unique family of custom micropower monolithic integrated circuits. As a micro-miniature radio telemetry system, the device can be totally implanted within the body. Author

N74-12590 Stanford Univ., Calif. Electronics Labs.
A ONE-HAND OPTACON **c05**
Roger D. Melen *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 3 p refs (For availability see N74-12580 03-34)
Copyright.

The Optacon is a portable reading aid for the blind. It uses a 24 x 6 custom fabricated monolithic phototransistor array to detect the print and a 24 x 6 array of piezoelectric vibrators to present a tactile image to the fingertip. It is a direct translation device that displays one printed character at a time. Blind users have attained reading rates of 60 words per minute using this machine. Author

N74-12591 California Univ., Berkeley. Dept. of Electrical Engineering and Computer Sciences.
ENGINEERING-TYPE MODELS OF INFECTIOUS DISEASES **c05**
Edwin R. Lewis and Keh-Low Lee *In* WESCON The 1973 WESON Tech. Papers, Vol. 17 1973 9 p refs (For availability see N74-12580 03-34)
(Grant NSF GK-3845)
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The rate-variable approach, which applies the principle of continuity of flow, is introduced and discussed. The development of network models of population dynamics from the rate-variable approach is presented, along with specific, detailed application to the problem of finding optimum control strategies for a very serious endemic disease, snail fever (schistosomiasis). The modeling results suggest that a threshold exists, below which the endemic will gradually die away, and that the timing of control measures can be crucially important in determining their effectiveness. Author

N74-12592 Continental Consultants, Inc., Devon, Pa.
COMPUTER AIDED TEST DESIGN TODAY **c08**
Harry D. Kimp *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 9 p (For availability see N74-12580 03-34)
Copyright.

Some typical testing problems encountered in test program design for complex avionics systems are discussed. The need for computer aided test design in meeting current needs is explained. Emphasis is placed on describing computer aided digital and analog test design systems available today and to highlight desirable features of these systems. Author

N74-12593 Digitest Corp., Dallas, Tex.
ESTABLISHING TEST REQUIREMENTS FOR DIGITAL NETWORKS **c10**
In WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p ref (For availability see N74-12580 03-34)
Copyright.

Techniques have been developed to evaluate tests for large networks. A D-LASAR subsystem ISOGEN generates a fault isolation dictionary and evaluates percent detection on a detailed gate fault basis for networks to 400ICs in less than one hour 1108 or 360/65 computer time. These evaluations have shown that while manually prepared tests for small networks sometimes rate 90%, those for networks greater than 100ICs seldom rated better than 50% detection. The basic performance functions of the D-LASAR system are discussed after first considering the need for high quality testing. Author

N74-12594 Fairchild Camera and Instrument Corp., Palo Alto, Calif.
FAIRTEST: A SYSTEM FOR COMPUTER AIDED DESIGN OF TEST PROGRAMS FOR DIGITAL LOGIC MODULES **c10**
Ernest J. Collins *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 13 p (For availability see N74-12580 03-34)
Copyright.

FAIRTEST is a proprietary computer aided test generation system used to provide test programs for digital logic modules. Described are the general nature and capability of the modules which comprise the system with examples of application to a macro model of a JK flip flop and to a sample network which uses that macro. Author

N74-12595 AAI Corp., Baltimore, Md.
COMPUTER AIDED TEST GENERATION FOR ANALOG CIRCUITS **c10**
A. M. Greenspan and L. J. Rytter *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p (For availability see N74-12580 03-34)
Copyright.

The use of CAP is shown to be an effective means for reducing the cost and time required for preparing programs to test analog circuits. The effect of improper modeling was found to result in the CAD processor not converging to a solution or incorrection solutions for node voltages. Improper parameter data will also distort the results of the CAD processor. Author

N74-12596 INTEL Corp., Santa Clara, Calif.
IMPACT OF MICRO COMPUTERS ON THE DESIGNER **c08**
H. Smith *In* WESCON The 1973 Wescon Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

The uses and advantages of micro computers are reviewed. The architecture and design aids for micro processors are also considered, including software and hardware. J.A.M.

N74-12597 National Semiconductor Corp., Santa Clara, Calif.
APPLICATIONS OF LSI PROCESSORS **c10**
Bala Parasuraman *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 8 p refs (For availability see N74-12580 03-34)
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The microprocessor is used in connection with LSI processors that incorporate resident microprograms for CPU implementation. The majority of processor families incorporate parallel architectures. The future probabilities of LSI processors are briefly discussed. J.A.M.

N74-12598 Computer Automation, Inc., Irvine, Calif.
HOW ABOUT THE LOW COST ($1000) MINICOMPUTER? **c08**
Phillip A. Kaufman *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)
Copyright.

Microprocessors versus minicomputers are examined. Many of the differences in performance, cost, and methods of application are discussed. The low cost minicomputer, NAKED MINI/LSI, is discussed in relation to both conventional minicomputers and the new microcomputers. AUthor

N74-12599 Techexport, Inc., Cambridge, Mass.
THE AGENT AS A VEHICLE FOR EXPORT MARKETING
In WESCON The 1973 WESON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
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Various types of agency arrangements that can be used to successfully enter export markets are presented. There are a large number of sales agencies overseas that are also systems companies and even manufacturers. Author

N74-12600 California State Univ., Long Beach.
NEEDS AND TRENDS IN MEDICAL ELECTRONICS 1973: SESSION 13 OVERVIEW **c05**
Morton D. Schwartz *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

Today's health care industry, changing patterns in health care, and influence of government on health care are discussed. Future needs and trends for public health programs and care are briefly reviewed. J.A.M.

N74-12601 University of Southern Calif., Los Angeles. Biomedical Engineering Inst.
CLINICAL ENGINEERING AND THE MEDICAL INSTRUMENTATION MARKETS **c05**
Malcom G. Ridgway *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
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Through programs, which are being actively promoted by local hospital associations, and thus promise to spread rapidly, hosptials of all types and sizes within a particular geographical area can obtain access to a range of practical engineering services conveniently and economically. These services include equipment maintenance and calibration and staff instruction programs to ensure that the equipment is used properly and safely. With local professional biomedical engineering assistance, the hospital group establishes its own nonprofit engineering organization and arranges to share among the participating hospitals, the services of both in-house and regional engineering teams. Author

N74-12602* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MEDICAL ELECTRONICS: A NEED AND A CHALLENGE **c05**
John Dimeoff *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

Space programs have led to the development of telemetry pills for diagnosis of diseases of the digestive tract, reusable X-ray image storage plates that require no chemical processing, and muscular augmentation systems for the handicapped. These examples, together with countless other examples of technological innovation that can be drawn from research and development programs supported by government funds, offer a potential opportunity to stimulate growth and to control rising costs in medical electronics. Author

N74-12603 Western Electronic Show and Convention, Los Angeles, Calif.
RECENT COMMERCIAL MEDICAL ELECTRONIC DEVELOPMENTS IN CARDIOVASCULAR AND CANCER TREATMENT **c05**
Norman A. Austin *In its* The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)
Copyright.

The integrated circuit has made possible a new family of portable battery operated devices for emergency treatment and diagnosis of cardiovascular problems. These include defibrillators that are used to restore normal heart rhythm, radio communications, EKG tape recorders, and heart rhythm audio warning devices. The bouncing ball P-7 phosphor scope display is being replaced by MOS shift register memory refreshed displays. In radiation therapy of cancer, the transition is being made to electron linear accelerators from cobalt 60. Author

N74-12604 Sandia Labs., Albuquerque, N.Mex.
EXPANDABLE MODELING OF BIPOLAR DEVICES **c10**
J. G. Fossum *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs Sponsored by AEC (For availability see N74-12580 03-34)
Copyright.

A technique for modeling bipolar devices is described. It results from a consolidation of modeling approaches. The application of the technique results in large signal models which are amenable to computer-aided circuit analysis and design. The models are formulated such that they realistically project the associated device physics. They can be systematically altered in complexity and completeness, or accuracy, to efficiently meet the user's requirements and/or to reflect improvements and refinements in the states of the art of device processing and analysis; i.e., they are expandable. Author

N74-12605 Bell Telephone Labs., Inc., Holmdel, N.J.
CHOOSING THE RIGHT MODEL **c10**
W. J. McCalla *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs (For availability see N74-12580 03-34)
Copyright.

The confusion concerning the similarities and differences in bipolar junction transistors is discussed. Model orientation, accuracy, and cost are reviewed. The device, circuit, and system designs are also described. J.A.M.

N74-12606 Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
A BIPOLAR TRANSISTOR MODEL FOR DEVICE AND CIRCUIT DESIGN **c10**
Ronald B. Schilling *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 2 p refs (For availability see N74-12580 03-34)
Copyright.

The regional approximation method is used to develop a model satisfying the above requirements. The regional approximation method is based on dividing the transistor into physically defined regions. By combining this technique with computer monitoring of approximations, significant simplifications can be self-consistently made, while a high level of accuracy can be maintained. Results demonstrate that an analytically tractable determination of transistor parameters can be obtained under wide ranges of device operation. Author

N74-12607 Arizona State Univ., Tempe. Dept. of Electrical Engineering.
AN INTEGRAL CHARGE CONTROL MODEL (ICCM): THEORY AND EXPERIMENT **c10**
Carl R. Zimmer *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs (For availability see N74-12580 03-34)
Copyright.

A simple ICCM is discussed which uses four model parameters in the integral charge control relation and two in the base current represented as a single nearly-ideal component. All parameters may be directly measured, with the exception of the knee current, which is adjusted to match the experimental maximum in the h sub FE vs. I sub C curve. Author

N74-12608 Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
IMPATT AMPLIFIERS FOR COMMUNICATION SYSTEMS **c07**
H. C. Bowers and W. H. Lockyear *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)
Copyright.

Negative resistance IMPATT and Gunn diodes are discussed, emphasizing their performance. Two types of amplifiers, stable and injection locked, can be used in communications. Typical impedances for packaged IMPATT and Gunn devices are shown, along with X band amplifier power capabilities. J.A.M.

N74-12609 Litton Industries, San Carlos, Calif.
A TWO WATT GUNN EFFECT TELECOMMUNICATIONS TRANSMITTER SOURCE **c07**

G. E. Lindgren *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

A 2 watt Gunn effect solid state transmitter source is described that is particularly useful to communication companies working in the 10.7 GHz to 13.25 GHz common carrier, business, and CARS bands. The transmitter source is direct modulated, i.e., the baseband information is used to frequency modulate the microwave carrier directly and does not require intermediate steps as in the heterodyne systems. Data is presented for a source designed specifically for the 10.7 GHz to 11.7 GHz common carrier band. Author

N74-12610 California Microwave, Inc., Sunnyvale.
PRESENT CAPABILITIES OF PHASE-LOCK OSCILLATORS **c10**
Irvin H. Solt, Jr. *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p (For availability see N74-12580 03-34)
Copyright.

The operation and major advantages of phase-lock sources are described. Different types of phase-lock systems are described. These are most commonly used to satisfy the many microwave system requirements. Current performance data is presented with particular emphasis on FM noise and modulation characteristics. Author

N74-12611 Farinon Electric, San Carlos, Calif.
COMPUTERIZED OPTIMIZATION OF MICROWAVE OSCILLATORS **c10**
Les Besser *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

A quick and accurate approach for optimizing varactor-tuned microwave transistor oscillators is described. The initial approximation is based on the small signal scattering parameters of the active two-port through which the circuit is systematically optimized by COMPACT. The object of the optimization is to maximize negative resistance and minimize phase shift at the tuning port, and to provide minimum reflection coefficient at the output port. The final design includes convenient check points where the actual circuit can easily be adjusted to correlate with the predicted impedances. The resultant 2.5-2.9 GHz discrete oscillator delivers + 18 dbm, using an HP-21 transistor in the 70 mil pil-package. The above range of frequencies requires less than 5 volts dc tuning voltage change. Author

N74-12612 INTEL Corp., Santa Clara, Calif.
N-CHANNEL RAMS **c26**
A. C. Markkula, Jr. *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

A current status report on the state of the art in memory components and an indication of future expectations is presented. Semiconductor memory components are constructed using one of three basic technologies; bipolar, N-channel MOS or P-channel MOS. Although there are many important variations within each of the three technologies, only N-channel silicon gate MOS are discussed and examples are drawn from some of the others for comparison purposes. It appears that over the long term, N-channel will be the dominant process used for semiconductor memory components. Author

N74-12613 Motorola, Inc., Phoenix, Ariz.
SYSTEM APPLICATIONS FOR 4K RAM'S **c26**
Bud Broeker *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 1 p (For availability see N74-12580 03-10)
Copyright.

The features of N-channel 4K RAMs are discussed, which simplify the design of memory systems. The MCM6605 4K RAM is considered a typical memory in providing a master timing control system. Error correction techniques are described. F.O.S.

N74-12614 National Semiconductor Corp., Santa Clara, Calif.
THE PROGRAMMABLE LOGIC ARRAY AS A DESIGN TOOL **c10**
Dale Mrazek *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p (For availability see N74-12580 03-34)
Copyright.

The programmable logic array (PLA) is discussed. As the name suggests, a PLA is an array of logic elements such that a given input function produces a known output function. In this sense, the device could be as simple as a gate or as complex as a read only memory. Applications range from the slowest and smallest systems, such as traffic light controllers, to fast, high performance and complex large digital processors. The PLA is described and its advantages over alternate logic forms demonstrated. Author

N74-12615 Hewlett-Packard Co., Cupertino, Calif.
IMPACT OF RECENT ADVANCEMENTS OF MEMORY TECHNOLOGIES ON PRODUCTS **c08**
Alan D. Marston *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 8 p (For availability see N74-12580 03-34)
Copyright.

The principle characteristics of the different types of memories available are reviewed, and design parameters that should be considered are presented. This review is followed by examples of how these memory devices can be applied to representative types of products in the computer, calculator, terminal, and instrument fields. Highlight characteristics of certain new technologies with a reasonable potential of becoming available within the near term are briefly mentioned. Author

N74-12616 Bio-Optronics, Inc., Van Nuys, Calif.
THE MEDICAL INSTRUMENT COMPANY ASSAY: 24 CARAT OR FOOL'S GOLD?
Harold B. Rose *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

An introspective reflection is presented of an ex-aerospace and industrial instrumentation engineer's experience in the development of a new medical instrument company. The founding, initial product development, marketing, production, quality control, and financial traumas that are intrinsic in a new company situation are discussed. Author

N74-12617 Veterans Administration Biomedical Engineering and Computing Center, Sepulveda, Calif.
EMPLOYMENT OPPORTUNITIES FOR ENGINEERS IN THE BIOMEDICAL FIELD, REAL OR IMAGINARY?
Fred J. Weibell *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)
Copyright.

An attempt to answer pertinent questions that must be considered by an engineer contemplating a change to a career in the biomedical field is reported. A realistic assessment of the biomedical engineering job situation today and an educated glimpse into the future are provided. A new cooperative effort to disseminate information about biomedical job opportunities throughout Southern California is also briefly described. Author

N74-12618 University of Southern Calif., Los Angeles.
CLINICAL ENGINEERING AS A RESOURCE FOR NEW PRODUCT DEVELOPMENT
George A. Bekey *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

Problems associated with innovation in the biomedical instrumentation industry are discussed. The lack of an organized structure for getting design requirements from the clinical environment to the product developer is highlighted, along with other problems particular to this industry. Various solutions to the problem are discussed, using the development of the heart pacemaker as a prototype. The possible role of a nonprofit Clinical Engineering Institute as a catalyst to aid innovation in the biomedical instrumentation industry is presented. Author

N74-12619 Spacelabs, Inc., Chatsworth, Calif.
A CASE HISTORY OF TECHNOLOGY TRANSFER FROM AEROSPACE/DEFENSE APPLICATIONS TO COMMERCIAL/INDUSTRIAL MEDICAL INSTRUMENT PROD-

UCT DEVELOPMENT PROGRAMS
Donley J. Valiquette *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 2 p (For availability see N74-12580 03-34)
Copyright.

The process is described of converting the technology of a small aerospace bioinstrumentation company to a product based patient monitoring company which has taken five years. The company is Spacelabs, Inc. of Chatsworth, California. Five years ago the company's sales were 100% to government and aerospace bioinstrumentation customers. The largest single customer was the National Aeronautics and Space Administration representing in excess of 75% of the sales. Today, the company's sales are 100% in the patient monitoring equipment market to hospitals throughout the world. Author

N74-12620 Tektronix, Inc., Beaverton, Oreg.
WILL INTERCONNECTABLE PLUG-INS MEET YOUR TEST AND MEASUREMENTS NEEDS BETTER? c10
Jerry L. Shannon *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1972 4 p (For availability see N74-12580 03-34)
Copyright.

Technological advances have reduced the cost of electronic components in modern instruments. Efforts to reduce packaging costs as well have led manufacturers to multifunction instruments. This multifunction concept is discussed including the Tektronix TM 500 plug-in instrument series. Author

N74-12621 Hewlett-Packard Co., Palo Alto, Calif.
SYNERGISTIC TRENDS IN DIVERSE CAPABILITY INSTRUMENT DESIGN c14
James F. Horner *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs (For availability see N74-12580 03-34)
Copyright.

The roll is examined of the synergistic process in the present trend of instrument diversification. The background and causes of the present trend toward instrument diversification are examined, and then how synergistic products may help keep this trend a viable alternative are indicated. Factors encouraging instrument diversification are shown to be those of size and economy. Limitations to this trend are the areas of electrical and mechanical interface and user flexibility. Examples of synergistic products are included. Author

N74-12622 Systron Donner Corp., Culver City, Calif.
A NEW 'VALUE CONCEPT' IN TEST INSTRUMENTATION c14
Howard W. Mette *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

The VERSATESTER concept recognizes the realities of test instrumentation requirements in the three basic test disciplines: R and D, Production and Service. These realities are that a testing situation invariably requires both signal generating (stimulation) and result gathering (measurement) equipment, and that the great majority of day to day test requirements are satisfactorily accomplished with inexpensive, unsophisticated, general purpose equipment. The VERSATESTER concept further recognizes the impact that integrated circuit technology is having on the design of test instrumentation, i.e., a high degree of capability can be contained in an extremely small packaging volume, and the cost of producing it is drastically reduced relative to pre-IC standards. The VERSATESTER concept combines these facts and carries them one logical step forward to create instrumentation having maximum useful capability per physical volume and cost. Author

N74-12623 California Instruments Co., San Diego.
THE DIGITAL MULTIMETER/COUNTER (DMCtm) c08
William E. Barker *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 3 p (For availability see N74-12580 03-34)
Copyright.

The design and commercial production of a series of digital multimeter/counters (DMC) are discussed. Emphasis is placed on the advanced capabilities of a recently developed model, referred to as the DMC 45. The DMC 45 offers the six most used functions in one compact portable instrument. One of it's features is the 300% overrange on all functions except the counter function which is limited to 20 megahertz. Another feature, which is considered to be of particular interest, is the low frequency capability of the meter. These features and all of the other capabilities of the instrument are described in detail. D.L.G.

N74-12624 Hewlett-Packard Co., Palo Alto, Calif.
PERFORMANCE CHARACTERISTICS AND FUTURE APPLICATIONS OF LOW NOISE BIPOLAR TRANSISTORS c26
Sanehiko Kakihana *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 8 p (For availability see N74-12580 03-34)
Copyright.

The present status of the bipolar transistor is evaluated and its future potential as a low noise amplification device is assessed. A comparison is presented of present bipolar microwave transistors and GaAs MESFETS. It is concluded that the comparison casts a rather gloomy future for the bipolar microwave transistor, at least in the frequency range above 6 GHz. In assessing the future potential of the bipolar transistor, it is felt that the ion implantation technique will improve the fabrication yield of the low noise transistor, but it is not clear if the implantation technique will significantly contribute to further improvement of the performance. D.L.G.

N74-12625 Watkins-Johnson Co., Palo Alto, Calif.
PERFORMANCE CHARACTERISTICS AND FUTURE APPLICATIONS OF LOW NOISE GALLIUM ARSENIDE FET'S c26
John A. Eisenberg *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

The gallium arsenide field effect transistor is currently the object of a great deal of interest in the microwave community. This interest stems from the high gains and low noise figures that the device is capable of throughout the microwave spectrum to X-band. The history of the device, the current state-of-the-art, circuit design considerations, results, and future trends of GaAs FET microwave amplifiers are discussed. The present and future capabilities and limitations of the GaAs FET as a low noise microwave amplifier are analyzed. Author

N74-12626 Varian Associates, Palo Alto, Calif.
MILLIMETER AND MICROWAVE TEA CIRCUITS AND PERFORMANCE c10
R. E. Goldwasser *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)
Copyright.

In the past, GaAs millimeter wave amplifier performance has been limited by narrow bandwidths and low output powers. The design and performance are discussed of two-stage amplifiers from 36 to 40 GHz having 21 db small signal midband gain, saturated power outputs in excess of 170 mW, and first stage noise figures as low as 16.2 db. Author

N74-12627 Varian Associates, Palo Alto, Calif. Solid State West Div.
DESIGN AND FABRICATION OF TRANSFERRED ELECTRON (GUNN) AMPLIFIER DIODES c10
James F. Caldwell *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)
Copyright.

Three types of diode designs for Gunn amplifiers are analyzed. It is concluded that the stabilized supercritical GaAs diodes provide useful capability, with operation from C through Ka-band. Other findings include: (1) Appropriate chip parameters are established. (2) The theoretical basis for supercritical amplification is not precisely established. (3) InP and/or unconventional cathode and anode structures show potential for low noise Gunn amplifiers. (4) Gunn diode amplifiers are capable of gain, power output, and noise performance suitable for their

consideration in a wide range of applications where no solid state amplifiers were previously available. Author

N74-12628 Hewlett-Packard Co., Palo Alto, Calif.
THE CENTRAL PROCESSOR UNIT (CPU): AN INTEGRAL PART OF MEASURING INSTRUMENTS **c10**
France Rode *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

Several areas are discussed in which the introduction of a central processor unit (CPU) not only could improve present measurement methods but also make new measurement and new instruments possible. An example is given in which time intervals are measured with 100 picosecond resolution. Other examples include the linearizing of a transducer and solving an equation by the use of a small CPU combined with some skillful programming. Author

N74-12629 Tektronix, Inc., Beaverton, Oreg.
INTELLIGENCE IN ACQUISITION, PROCESSING, AND DISPLAY **c14**
Bruce Hamilton and Luis Navarro *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)
Copyright.

Most measurement instruments consist of three functional sections: acquisition, processing, and display. The benefits of using intelligence with each of the three functions is explored. Two different approaches to implementing intelligence, including special purpose logic and general purpose programmable structures, are examined. Finally the importance of software for general purpose, programmable intelligence is analyzed. Author

N74-12630 TIME-DATA Corp., Palo Alto, Calif.
INTELLIGENCE IN INSTRUMENTATION **c14**
Leo J. Chamberlain *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 3 p (For availability see N74-12580 03-34)
Copyright.

Two aspects of intelligence in instrumentation are discussed; the physical intelligence that should be designed into instrumentation, and the human intelligence necessary for the designer to decide what and how much physical intelligence to design in. The two aspects are illustrated by examining the instrumentation required to analyze or control electrical signals by or immersed in unwanted and interfering noise. Author

N74-12631 Federal Aviation Administration, Washington, D.C. Microwave Landing System Branch.
MLS PROGRAM: PHASE 2 **c21**
Jack W. Edwards *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 9 p refs (For availability see N74-12580 03-34)
Copyright.

The National Plan for Development of the Microwave Landing System is overviewed and its current status is discussed. Phase 2 of the program is described in terms of objectives, issues, planning considerations, and content. Author

N74-12632 Philco-Ford Corp., Palo Alto, Calif. Western Development Labs.
COMPONENT TECHNOLOGY STATUS OF GIGABIT DATA RATE QUADRIPHASE SYSTEMS **c08**
Louis C. Cuccia *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

The basic technologies are described which have made possible the development of digital transmission systems using phase-shift-keying operating at gigabit-per-second rates. These technologies, based on new high frequency diodes, transistors, and integrated circuits, have produced a family of phase-shift modulators, special multipliers, video amplifiers, and highly stable phase-locked oscillators which can accommodate the subnanosecond switching rates required. Author

N74-12633 General Motors Technical Center, Warren, Mich. Engineering Staff.
AUTOMOTIVE RADAR: PROBLEMS AND PROMISES **c07**
T. O. Jones, D. M. Grimes (Mich. Univ., Ann Arbor), R. A. Dork, and W. R. Regueiro *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 8 p refs (For availability see N74-12580 03-34)
Copyright.

The future potential and problems in the field of automotive radar are surveyed. Both the roadside environment in which the car and driver operate and on-board physical environments in which the electronics must function are treated. Applications involving speed sensing, predictive crash sensing, obstacle detection, braking, and station keeping are addressed. Current radar system state of the art is reviewed. Considerations relating to target discrimination, weather penetration, and basic radar system parameters are covered. Modulation techniques for range determination are examined, and radar system configurations are discussed in an effort to identify the advantages and disadvantages of each. It is concluded that much development work remains and that significant progress must be made before radar becomes a practical automotive system. Author

N74-12634 Western Electronic Show and Convention, Los Angeles, Calif.
INTRUSION SENSORS **c14**
John H. Bryant (Omni Spectra, Inc.) *In its* The 1973 WESCON Tech. Papers, Vol. 17 1973 12 p ref (For availability see N74-12580 03-34)
Copyright.

An overview is presented of the various types of intrusion sensors. The types described include: radio, ultrasonic, passive infrared, and microwave. The application of intrusion sensors in the design of alarm systems is discussed. A microwave volumetric intrusion sensor and an outdoor microwave intrusion sensor are considered in terms of their particular areas of utilization. D.L.G.

N74-12635 Parente (Robert B.), Los Angeles, Calif.
POWER SOURCE QUALITY **c03**
Robert B. Parente *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 3 p (For availability see N74-12580 03-34)
Copyright.

The various source deficiencies which can occur in the quality of ac electric power serivce, their potential consequences upon the performance of electronic equipment, and their cures are surveyed. These deficiencies include blackouts, brownouts, and waveform distortion. The information is considered to have particular application in plant siting, operations, or the preparation of specifications for new electronic equipment. Author

N74-12636 Federal Aviation Administration, Washington, D.C.
POWER CONDITIONING SYSTEM FOR FAA AIR ROUTE TRAFFIC CONTROL CENTERS **c03**
Anthony J. Froehlich and Alexander Kusko (Kusko (Alexander), Inc., Needham Heights, Mass.) *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)
Copyright.

The FAA is presently installing 18,000 kVA of solid state UPS equipment to supply power at high reliability to critical electronic loads at 20 air route traffic control centers (ARTCC's) in the U.S. The requirements for a power conditioning system for ARTCC's are given, and two approaches to meet these requirements are discussed. D.L.G.

N74-12637 Lockheed Electronics Co., Los Angeles, Calif.
COMPUTER POWER SUPPLY CONSIDERATIONS **c08**
Donald F. Olker *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)
Copyright.

Computer power systems and tradeoffs that can be made to optimize them are discussed along with production costs of the systems. Author

N74-12638 ACDC Electronics, Inc., Oceanside, Calif.
THE MULTIFORMITY OF POWER SUPPLY EQUIPMENT

c08

Walter J. Hirschberg *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p (For availability see N74-12580 03-34)

Copyright.

Reasons for the existence of a multitude of power supplies being built, the different technical approaches, and the particular suitability of one technical approach over another in light of specific requirements are presented. While requirements may focus on any one of many possible critera, only power equipment delivering more or less well regulated dc voltages to power electronic equipment is discussed. Author

N74-12639 Fluidyne Instrumentation, Oakland, Calif.

CALCULATOR-BASED SYSTEMS: PLUG-IN DATA ACQUISITION AND PROCESS CONTROL c08

Roger Jennings *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)

Copyright.

The use of programmable calculators to reduce the cost of automated data acquisition and process control capabilities in industry is discussed. Advantages, including plug-in interfaces and simplified programming are examined. Data also cover the following disadvantages: (1) low operating speeds, and (2) lack of interrupt structure and inability to automatically restart operation after power failure. Author

N74-12640 Tektronix, Inc., Beaverton, Oreg.

DATA ACQUISITION, PROCESSING AND DISPLAY - CALCULATORS-BASED c08

Jack D. Grimes and Ronald V. Hill *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)

Copyright.

The calculator-based instrumentation concept and three categories of hardware are discussed. The categories are: (a) acquisition of information, (b) processing the information, and (c) display or utilization of the information to achieve the desired result. Important design parameters are identified and discussed in each category. The acquisition of information is discussed with respect to versatility of the hardware and its ability to acquire information from a variety of sources. The processing of information is discussed with the emphasis on capability, software requirements, and the speed-cost trade-off. The utilization of the processed information is treated from the viewpoint of allowing the information to be utilized in a variety of ways. An existing calculator based system is discussed with respect to the above categories. Author

N74-12641 Hewlett-Packard Co., Loveland, Colo.

SYSTEMS TYPE MEASUREMENTS IN THE LABORATORY USING PROGRAMMABLE BENCH INSTRUMENTS UNDER CALCULATOR CONTROL c14

Peter S. Stone *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p refs (For availability see N74-12580 03-34)

Copyright.

The basic advantages of a systems approach to certain kinds of laboratory measurements and how calculator control over a standard interface has made it practical are discussed. Several specific examples are discussed to illustrate the power and flexibility of this approach. Author

N74-12642 Packett Communications, Inc., Waltham, Mass.

COMMUNICATIONS ARE TOO MUCH WITH US c07

Lee R. Talbert *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)

Copyright.

Packet switching technology and its application to national public high performance data communications systems is discussed. The technology covers network design, distribution network control, and low cost minicomputers. Capabilities of the system include more efficient line utilization, greater reliability, higher transmission speeds, and greater flexibility than any other available computer communications systems. E.H.W.

N74-12643 Southern Pacific Communications Co., San Francisco, Calif.

SOUTHERN PACIFIC COMMUNICATIONS COMPANY AND THE SPECIALIZED COMMON CARRIERS c07

John J. Geier *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)

Copyright.

Southern Pacific Communications Company (SPCC) operations are discussed Data cover long haul service, terminal equipment, and the drop from the local terminal to the customer's premises. The SPCC network phases and timetable are also discussed. Author

N74-12644 Pacific Telephone and Telegraph Co., San Francisco, Calif.

DATAPHONE DIGITAL SERVICE c07

R. A. Hiett *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)

Copyright.

Design principles and performance parameters are given for a dataphone digital service. System objectives include: (1) minimal downtime, (2) rapid restoral, and (3) end-to-end transmission performance that will average no more than one error second in 200 seconds of transmission at 56 kilobits per second; better performance is expected at a lower speeds. Tests results indicate that an average downtime will be between three and four hours per year with restoral of not more than a single outage per two hour period. E.H.W.

N74-12645 Fisher (Charles R.), San Diego, Calif.

THE ANALOGY OF THE EVOLUTION OF UTILITY NETWORKS TO COMPUTER COMMUNICATIONS c07

Charles R. Fisher *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 2 p refs (For availability see N74-12580 03-34)

Copyright.

Existing public utility networks are compared to projected computer utility networks. Similarities of capability dispersion are noted. Degrees of transparency of various utilities are also compared. Additionally, some criteria for billing or tariff purposes are discussed. Author

N74-12646 Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.

REVIEW OF ANOMALOUS SCATTERING OF PLZT CERAMICS OF HIGH LANTHANUM CONTENT c18

A. S. Khalafalla, D. Burbank, and J. Jurisson *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)

Copyright.

The scattering mode of operation of a few lanthanum-modified, hot pressed lead zirconate, lead titanate ceramics was investigated in an attempt to optimize their performance in display devices. At small scattering angles, the thermally depoled state in these PLZT ceramics scatters less light than the poled material. The scattered light is essentially independent of temperature for the thermally depoled state. By contrast, light scattering decreases sharply with temperature rise for the poled PLZT. In the PLZT with 7 percent La, scattering was enhanced when the poling field was left on the material during heating, while that containing 8% and 9% La exhibited a sudden drop of light scattering at 40 and 15 C to the depoled level when the electrodes were shorted during heating. Author

N74-12647 Sandia Labs., Albuquerque, N.Mex.

ELECTRO-OPTIC DEVICES UTILIZING QUADRATIC PLZT CERAMIC ELEMENTS c18

J. Thomas Cutchen, J. O. Harris, Jr., and G. R. Laguna *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 12 p refs Sponsored by AEC (For availability see N74-12580 03-34)

Copyright.

A review was made of several devices which use PLZT ceramic materials characterized by the quadratic transverse electro-optic effect. Operational and prototype devices discussed include large aperture fastshutter applications in flashblindness protection, welding, and other industrial operations, and a small aperture application as a page composer for a holographic memory; in addition, some display applications were demonstrated. The

extension of present development progrms to industrial utilization appears to be very feasible. Author

N74-12648* Radiation, Inc., Melbourne, Fla.
PLZT BLOCK DATA COMPOSERS OPERATED IN DIFFERENTIAL PHASE MODE c18
M. D. Drake and D. E. Klingler *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
(Contract NAS8-26672)
Copyright.

The use of a PLTZ block data composer as a matrix type phase modulator to record and process digital data by the differential phase mode in a holographic recording/processing system was investigated. The system has readout contrast ratios of between 10 and 15 to 1. The differential phase mode has the advantage that strain bias is not required and thickness and strain variations in the PLZT are cancelled out. Author

N74-12649 Sandia Labs., Albuquerque, N.Mex.
SELF-LIMITING ELECTRO-OPTIC VARIABLE DENSITY FILTERS c18
D. G. Schueler and W. D. Smith *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs Sponsored by AEC (For availability see N74-12580 03-34)
Copyright.

Operating principles of a self limiting electro-optic variable density filter, for both static and dynamic light conditions, are outlined. Several applications and prototype filters are included. Theoretical results show that: (1) for slowly changing illumination, transmitted intensity never exceeds a peak value determined by the design parameter alpha, and (2) for abrupt increases in illumination, the total excess energy transmitted during the transient response is a constant independent of the illumination level. Author

N74-12650 Bell Telephone Labs., Inc., Whippany, N.J.
EVALUATION OF PLZT CERAMIC DISPLAY DEVICE FOR HIGH-SPEED INTERACTIVE DATA DISPLAYS c18
J. A. DiSabato and D. B. Fraser *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

The development of a high speed interactive data display that converts slowly changing electrical input data into a visual format is evaluated. The PLZT ceramic photoconductor display device (FERPIC) was evaluated for use in a high speed interactive data display where the ability to selectively erase and rewrite portions of the image is required. A display system using the FERPIC has permanent image retention without refreshing and yet the image may be electrically erased and the device reused. The interdependence and variation between contrast, resolution, and switching speed are discussed. Author

N74-12651 Litronix, Cupertino, Calif.
LIGHT EMITTING DIODES: A TUTORIAL c10
David A. Laws and Robert Santos *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p (For availability see N74-12580 03-34)
Copyright.

The fabrication, characteristics, and applications of light emitting diodes (LEDS) are discussed. LEDS provide the same solid state benefits to man machine systems of low cost and ease of use that integrated circuits have contributed to information processing systems. Examples of LEDS circuitry and electrical properties are provided. Author

N74-12652 Lewis (Robert E.), Palo Alto, Calif.
MEASURING INSTRUMENTS: VISUAL EFFECTIVENESS OF LED'S AND LIQUID CRYSTALS c14
Robert E. Lewis *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

Most displays of liquid crystals (LCD) and light emitting diodes (LED) are for visual use. Pocket calculators and electronic watches are typical. The way people see, the photometry and geometrical optics involved, and the goal of the effect benefit by systematic consideration of visual effectiveness as a means to select measurements used. Visual response is presented with emphasis on pertinent aspects, not seen recently in discussions of LED and LCD. This is followed by consideration of the visual surround and then to optics directly associated with the LED or LCD. From this, various test set-ups are suggested to establish routine instrument measurements relative to what the user will see. Author

N74-12653 Hewlett-Packard Co., Palo Alto, Calif.
LIQUID CRYSTAL DISPLAYS, THEIR PROBLEMS AND PROSPECTS c26
Sun Zu *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs (For availability see N74-12580 03-34)
Copyright.

Liquid crystal displays (LCDs) have many unique advantages such as low power, low cost, flexible in format, and immunity to washout. They also have many limitations in their performance characteristics, such as short lifetime, narrow temperature range, and slow speed. Some of these limitations will be reduced to an acceptable level as the technology progresses, but the inherent slow speed will limit the multiplexing of LCDs to a small number of digits. The solution to this problem appears to be very close at least for majority of the applications. As LCD devices become more available and more reliable, applications based on the consideration of better performance and cost will open up in the consumer mass market. Author

N74-12654 Fairchild Camera and Instrument Corp., Syosset, N.Y. Optoelectronics Div.
LEDS: A NEW MEASUREMENT STANDARD c14
Joseph S. Horwath *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p (For availability see N74-12580 03-34)
Copyright.

The development of calibration measurements for light emitting diodes is discussed. The properties, construction, and characteristics of the light emitting diodes are described. The anticipated minimum calibration measurements and procedures are analyzed to determine which calibration of the standards may be transferred to other secondary LED standards. Mathematical models are included to establish the nature of the calibration problem. Author

N74-12655 General Motors Corp., Kokomo, Ind. Delco Electronics Div.
AUTOMOTIVE ELECTRONICS c10
Ronald W. Vahle *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 12 p (For availability see N74-12580 03-34)
Copyright.

The application of solid state devices and monolithic integrated circuits for automobile systems is discussed. The specific applications include: (1) AM/FM radios, (2) voltage regulators, (3) electronic ignition, and (4) seat belt starter interlock. The reliability of automotive electronic equipment under various environmental conditions is analyzed. Author

N74-12656 Quadracast Systems, Inc., San Mateo, Calif.
QUADRAPHONICS: THE SOUND OF THE SEVENTIES c07
Lou Dorren *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p refs (For availability see N74-12580 03-34)
Copyright.

A history of the technological revolution in sound recording, replication, and reproduction is presented. Emphasis is placed on the field of quadraphonics. Specific examples of audio equipment are described and compared. Author

N74-12657 Signetics Corp., Sunnyvale, Calif.
A SOLID STATE TIMER DEVICE FOR THE CONSUMER c10
Jim Wyland *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p (For availability see N74-12580 03-34)
Copyright.

The development, characteristics, and application of a solid state timer device are discussed. Circuit diagrams are developed to show the components used in the design and to explain the

wave forms which produce the timing capability. Various uses of timing devices for operating home appliances are described.
Author

N74-12658 National Semiconductor Corp., Danbury, Conn.
STATE-OF-THE-ART IN AUDIO IC'S 1973 **c07**
Joe E. Byerly *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 13 p refs (For availability see N74-12580 03-34)
Copyright.

The development, characteristics, and applications of monolithic integrated circuits are discussed. The basic circuits which are analyzed are: (1) low noise preamplifiers, (2) minimum component audio amplifier, (3) high performance dual power amplifiers, and (4) high current power amplifier. Circuit diagrams are developed to show the components of the devices. Graphs are presented to show the electrical properties of the circuits.
Author

N74-12659 Fairchild Camera and Instrument Corp., Syosset, N.Y.
CAMERA ELECTRONICS: A NEW APPROACH **c14**
Donald E. Pezzolo *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p (For availability see N74-12580 03-34)
Copyright.

The integrated circuits which control the Polaroid SX-70 Land camera are described. Diagrams of the circuits are provided. Graphs of the electrical properties of the circuits are developed. The subsystems of the camera which involve integrated circuits are analyzed.
Author

N74-12660 Washington Univ., Seattle. Dept. of Electrical Engineering.
A HIGH PERFORMANCE SLOW SCAN TELEVISION MONITOR **c07**
Robert A. Greyell *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 6 p refs (For availability see N74-12580 03-34)
Copyright.

The characteristics of a slow scan television monitor are discussed. The monitor is designed to provide better picture quality and synchronization under a high noise and interference environment. The slow scan television standards are presented for the following: (1) video signal, (2) vertical, (3) horizontal, and (4) frequency modulated subcarrier. A block diagram is provided to show an integrated picture of the basic stage layout. The objectives to be fulfilled by each of the subsections are defined.
Author

N74-12661 Utah Univ., Salt Lake City. Dept. of Electrical Engineering.
LOSSES FROM MISALIGNED JOINTS IN SINGLE-MODE OPTICAL FIBERS **c23**
Robert J. Grow *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 7 p refs (For availability see N74-12580 03-34)
Copyright.

Values for power losses for transversely offset joints and angularly misaligned joints of single-mode optical fibers are given. The study reported was completed in response to the suggestion that power coupling through a joint can be enhanced by decreasing the diameter of the fiber core in the vicinity of the joint. Calculations are made by matching the fields of the zero-order mode at the joint and analytically integrating over the cross-sectional area of core and cladding. A scaled model of an optical fiber was designed and constructed at microwave frequencies. The core is composed of a 36-foot styrofoam rod of diameter 2.55 inches and dielectric constant 1.06. The cladding is simulated by the air around the rod. Measurements are taken for values of lateral offset and angular misalignment for microwave frequencies from 6 to 12.4 GHz.
Author

N74-12662 San Francisco State Coll., Calif.
A DIGITAL SIGNAL SCANNER **c07**
Grant Connell *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 5 p refs (For availability see N74-12580 03-34)
Copyright.

The characteristics of a digital signal scanner are discussed. The digital signal scanner is a receiving system which electronically tunes a selected band of frequencies. It is a complete system in which both digital and linear techniques are employed to achieve the desired tuning. The outstanding feature of the digital scanner is its ability to select stations without the use of expensive crystals. The two modes of scanning for VHF band tuning are described.
Author

N74-12663 California State Polytechnic Univ., Pomona.
DIGITAL ALARM CLOCK WITH A LIGHT-RING DISPLAY **c14**
Taylor Gahr *In* WESCON The 1973 WESCON Tech. Papers, Vol. 17 1973 4 p (For availability see N74-12580 03-34)
Copyright.

The design and development of a digital alarm clock are discussed. The electronic circuits designed to produce the conveniences of light display, touch plate control, two tone audio alarm, and readout capability are described. A block diagram is included to show the components of the clock.
Author

N74-12664 Pennsylvania Univ., Philadelphia.
SOLAR HEAT UTILIZATION IN RESIDENTIAL HEATING SYSTEMS Ph.D. Thesis
Abdüllah Ostad-Hosseini 1972 216 p
Avail: Univ. Microfilms Order No. 73-13447

A performance model of a solar collector was created in order to determine the useful heat which may be obtained from a flat plate solar collector. The model permits the calculation of the efficiency of a flat plate solar collector as a function of interplate spacing, incident solar radiation, number of plates, emissivity and absorptivity of the absorber, angle of incidence and other engineering variables. The model was used to compare different collector designs. The results are presented in graphical form suitable for system performance determination. A series of experiments yielded results within 5% of the analytical predictions. The computer program can predict the efficiency of solar collector as a function of date, time, location, and orientation of the collectors, the thermal and optical properties of glass and absorber plates, and the temperatures of the outside glass plate and the absorber plate. Weather data can be fed into the computer along with this program to obtain the yearly yield of solar heat.
Dissert. Abstr.

N74-12665 Oklahoma State Univ., Stillwater.
INTEGRATED RISK ASSESSMENT AND SCORING IN THE DEPARTMENT OF DEFENSE SOURCE SELECTION PROCESS Ph.D. Thesis
Everett Lane Thomas, Jr. 1972 315 p
Avail: Univ. Microfilms Order No. 73-15261

The problems associated with evaluating and scoring contractor proposals in the DoD Source Selection process are examined. What effects the minimum documentation and prototype hardware development concepts of the current DoD management philosophy may have on the Source Selection process are determined. The primary objective is to develop an integrated risk assessment and scoring model and procedural methodology for use by the Source Selection Evaluation Board. An initial risk model is developed and applied to the source selection activities for a major aircraft system which employs the current DoD management concepts. The results of a source selection questionnaire are evaluated to investigate the problems associated with the Source Selection evaluation and scoring process. An integrated risk assessment and scoring model is developed to enable source selection officials to obtain a relative measure of the over-all technical risk associated with each contractor proposal.
Dissert. Abstr.

N74-12666*+ National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY, JULY 1973. SECTION 1: ABSTRACTS
Jul. 1973 117 p refs
(NASA-SP-7039(03)-Section-1) Avail: NTIS HC $4.25 CSCL 05B

This bibliography is issued in two sections: Section 1 -

Abstracts, and Section 2 - Indexes. This issue of the Abstract Section cites 215 patents and applications for patent introduced into the NASA scientific and technical information system during the period of January 1973 through June 1973. Each entry in the Abstract Section consists of a citation, an abstract, and, in most cases, a key illustration selected from the patent or application for patent. This issue of the index Section contains entries for 2424 patent and application for patent citations covering the period May 1969 through June 1973. The Index Section contains five indexes -- subject, inventor, source, number and accession number. Author

N74-12667* + National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACT BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY, JULY 1973. SECTION: 2 INDEXES
Jul. 1973 419 p refs
(NASA-SP-7039(03)-Section-2) Avail: NTIS HC $8.25
For abstract, see N74-12666.

N74-12668# Committee on Science and Astronautics (U. S. House).
UNIVERSITY ENERGY RESEARCH CENTERS
Washington GPO 1973 52 p refs Hearing on H.R. 8348 and H.R. 9133 before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 11, 23 Jul. 1973
Avail: NTIS Avail: Subcomm. on Energy
A Congressional hearing is presented concerning the enactment of bills for enlisting the aid of academic researchers in carrying out energy R and D programs. Previous bills and past efforts are cited. The relationship between national laboratories to universities and the relation of either or both to private industry and the Federal Government, and to mission oriented projects associated with power engineering research are discussed. The designation of certain leading institutions and universities in certain fields is also considered. T.M.R.

N74-12669# Boeing Commercial Airplane Co., Seattle, Wash.
WHERE ARE WE HEADED IN AIR TRANSPORT?
L. T. Goodmanson 17 Oct. 1973 19 p Presented at Airport Operators Council Intern. Ann. Conf., Dallas, 17 Oct. 1973
Avail: NTIS HC $3.00
Certain trends are indicated for the future of air transport and a discussion on both cargo and passenger aircraft design options are given. An example from today's fleet of passenger airplanes is used to illustrate design improvement possibilities for current aircraft. This is followed by a discussion of new airplanes for both the near and far term. The passenger aircraft section includes a discussion on terminal area compatibility. The future cargo aircraft section covers a broad spectrum of designs, from conventional types of air freighters to new, dedicated intermodal systems. Some long range thinking about energy conservation and its effect on aircraft design is included. Author

N74-12670# Weapons Research Establishment, Salisbury (Australia).
[SIMULATION AND MODELING TECHNIQUES FOR SOLUTION OF COMPLEX SYSTEM PROBLEMS] Annual Report, 1972 - 1973
1973 57 p refs
Avail: NTIS HC $5.00
Research activities are reported in oceanology, sound ranging, radio wave propagation, systems study of field artillery fire control, and space programs. Trials activities, and advanced technologies are discussed along with consultation and services. F.O.S.

N74-12671# Helsinki Univ. of Technology, Otaniemi (Finland).
FACTORS AFFECTING DIRECTION OF INNOVATION SYSTEM [INNOVAATIO SYSTEEMIN OHJAUTUMISEEN VAIKUTTAVAT TEKIJAT]
Markku Nurmi 1973 177 p refs In FINNISH
(Research-Paper-45) Avail: NTIS HC $11.00
This study begins with the hypothesis that technological development in itself is not good or bad, but what is more essential is how the development is directed and how rapid that development is. On this basis, a method is developed by which technological development can be directed on a course desirable to society. Thus, it is essential to know which factors affect the directing of technological development, and how it is possible to cause the development to move in the desired direction with the aid of these factors. An innovation system is created which can be described, e.g., as an instant status of technological development. In other words, when a time factor is added to the innovation system, technological development is recieved. This has been used in Finland as an examination perspective. However, it should be possible, to generalize the results applicable to market-economy countries in general. Author

N74-12672# Committee on Science and Astronautics (U. S. House).
ENERGY FACTS
Washington GPO Nov. 1973 458 p refs Presented to Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 29 Nov. 1973 Prepared by Library of Congr.
Avail: Subcomm. on Energy
A congressional report on United States and foreign energy statistics is presented. Tables on the most common and some unconventional energy sources are developed. The statistical tables and graphs are grouped by resources, production, consumption and demand, energy and gross national products, and research and development. An inventory of world wide nonrenewable energy sources in the forms of natural gas, natural gas liquids, crude oil, shale oil, and coal is developed. Author

N74-12673*# National Aeronautics and Space Administration, Washington, D.C.
RESEARCH AND TECHNOLOGY OPERATING PLAN: A SUMMARY FISCAL YEAR 1974
[1973] 204 p refs
(NASA-TM-X-69456) Avail: NTIS HC $12.25 CSCL 05B
A compilation is presented of the summary portions of RTOPs used for management review and control of research. Citations and abstracts of RTOPs are included. A list is presented of RTOPs which have been changed, completed, or terminated since the last summary. Indexes presented include: subject, technical monitor, responsible NASA organization, and RTOP number. Author

N74-12674*# Auburn Univ., Ala. School of Engineering.
TERRASTAR: TERRESTRIAL APPLICATION OF SOLAR TECHNOLOGY AND RESEARCH Final Report
Sep. 1973 344 p refs
(Contract NGT-01-003-044)
(NASA-CR-129012) Avail: NTIS HC $19.25 CSCL 05A
The application of solar energy to the energy crisis of the 70's and beyond is discussed in the context of energy consumption in the U.S., energy resources in the U.S., and the state-of-the-art of solar energy applications. Solar energy application concepts, such as solar farms (a term used to describe vast fields of concentrators collecting solar energy for the generation of steam to drive power turbines), an orbiting solar power station, and the conversion of solar energy into solar power for heating and cooling of individual buildings on the earth, are discussed. The report emphasizes the application of solar energy to the heating and cooling of buildings since this application seems to be more promising in the near term as far as research and development are concerned. The importance of initiating research and development on all solar application concepts is stressed as an important step in pursuing the use of solar energy. Immediate steps leading to the application of solar energy to heating and cooling of buildings are outlined to insure appreciable energy displacement through the use of solar energy by the year 2020. For individual titles, see N74-12675 through N74-12685.

N74-12675* Auburn Univ., Ala.
ENERGY CONSUMPTION: PAST, PRESENT, FUTURE
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 27 p refs (For availability see N74-12674 03-34) CSCL 20M
The energy consumption history of the United States and the changes which could occur in consumption characteristics in the next 50 years are presented. The various sources of energy are analyzed to show the limitations involved in development and utilization as a function of time available. Several scenarios were prepared to show the consumption and supply of energy under varying conditions. Author

N74-12676* Auburn Univ., Ala.
ENERGY AND RESOURCE CONSUMPTION
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 10 p refs (For availability see N74-12674 03-34)
CSCL 20M

The present and projected energy requirements for the United States are discussed. The energy consumption and demand sectors are divided into the categories: residential and commercial, transportation, and industrial and electrical generation (utilities). All sectors except electrical generation use varying amounts of fossile fuel resources for non-energy purposes. The highest percentage of non-energy use by sector is industrial with 71.3 percent. The household and commercial sector uses 28.4 percent, and transportation about 0.3 percent. Graphs are developed to project fossil fuel demands for non-energy purposes and the percentage of the total fossil fuel used for non-energy needs.
Author

N74-12677* Auburn Univ., Ala.
ENERGY RESOURCES
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 34 p refs (For availability see N74-12674 03-34)
CSCL 20M

A statistical analysis of the availability of fossil fuels for energy and non-energy production is presented. The cumulative requirements for petroleum, natural gas, and coal are discussed. Alternate forms of energy are described and the advantages and limitations are analyzed. Emphasis is placed on solar energy availability and methods for conversion. The Federal energy research and development funding for energy sources is tabulated.
Author

N74-12678* Auburn Univ., Ala.
COMPONENTS FOR SOLAR ENERGY **c29**
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 14 p refs (For availability see N74-12674 03-34)
CSCL 20M

A requirement for the direct technological utilization of solar energy is a device for capturing and absorbing the available sunlight. These devices are commonly termed collectors. Because of the highly variable nature of sunlight, a facility for storing the collected energy is often essential. A device for direct conversion of light into electricity, which depends for operation on incident sunlight, is the photovoltaic cell. These components for solar energy systems are considered.
Author

N74-12679* Auburn Univ., Ala.
SOLAR HEATING AND COOLING BUILDINGS **c33**
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 28 p refs (For availability see N74-12674 03-34)
CSCL 20M

Sunshine is available in differing amounts everywhere in the world and the easiest method of capturing it is by absorption in the form of thermal energy (heat). Therefore, it is logical to utilize it directly in the heating and cooling of buildings and avoid losses that would occur by conversion to some other form. It may be emphasized that of the total energy consumed annually in the U.S., about 25% is used for heating and cooling in buildings. It is generally agreed that of all the possible widespread uses of solar energy, this application has the highest probability of success in the near term. Although there are significant uncertainties associated with some technological and economic aspects, they do not loom as large as those associated with other potentially significant applications, such as electrical power generation. It may, however, be noted that solar electrical power generation at the building site, or at a centralized station is an excellent long term prospect. Approximately 25 experimental solar heated structures have been built in various parts of the world.
Author

N74-12680* Auburn Univ., Ala.
SOLAR POWER GENERATION AND DISTRIBUTION **c03**
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 11 p refs (For availability see N74-12674 03-34)
CSCL 20M

The production of electricity from solar energy is discussed. The economics of the proposed generation and distribution systems are analyzed. The use of photovoltaics for converting solar energy to home heating is proposed. The problems of energy distribution are analyzed from the standpoint of equipment costs and complexity.
Author

N74-12681* Auburn Univ., Ala.
NATIONAL ENERGY POLICY
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 12 p refs (For availability see N74-12674 03-34)
CSCL 05A

The efforts of the U.S. government to cope with the national energy crisis are discussed. The provisions of several legislative actions to implement the actions for energy conservation are examined. Immediate conservation measures and the long range planning for energy resources are reported.
Author

N74-12682* Auburn Univ., Ala.
SOLAR ENERGY POTENTIAL **c03**
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 9 P ref (For availability see N74-12674 03-34)
CSCL 20M

The potential of solar energy as a national resource is discussed. Research and development programs for the development of eleven concepts are described to show the proposed funding for each year over a fifteen year period. The estimated energy contributions by period for each of the solar concepts are analyzed. The estimated impact of the solar concepts to the year 2020 are tabulated.
Author

N74-12683* Auburn Univ., Ala.
IMPACTS OF SOLAR ENERGY UTILIZATION **c03**
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 25 p refs (For availability see N74-12674 03-34)
CSCL 20M

Various methods of conducting surveys and analyses to determine the attitude of the public toward the energy crisis are discussed. Models to determine the impact of the energy crisis and proposed alternative sources of energy on the social structure are analyzed. The various interest groups which are concerned with energy and the nature of their interest are identified. The government structure for controlling resource production and allocation is defined.
Author

N74-12684* Auburn Univ., Ala.
MARKET POTENTIAL FOR SOLAR HEATING AND COOLING IN BUILDINGS **c33**
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 13 p refs (For availability see N74-12674 03-34)
CSCL 20M

The use of solar heating and cooling for buildings as a method of conserving fossil fuels is discussed. The residential and commercial end use consumption of energy is tabulated. A survey to project the energy requirements for home and industry heating and cooling is developed. The survey indicates that there is a market potential for solar heating and cooling of buildings. A prediction of three to five billion dollars per year as the potential for solar heating and cooling is made.
Author

N74-12685* Auburn Univ., Ala.
STRATEGY FOR SOLAR HEATING AND COOLING IN BUILDINGS **c33**
In its TERRASTAR: Terrest. Appl. of Solar Technol. and Res. Sep. 1973 159 p refs (For availability see N74-12674 03-34)
CSCL 20M

The types of solar energy heating and cooling equipment for use with buildings are discussed. The steps from manufacturing to equipment installation are identified. A feasibility study for the use of solar energy was conducted. The study determined the technical, environmental, economic, sociological, political, and strategic aspects of solar heating and cooling.
Author

N74-12686# Joint Publications Research Service, Arlington, Va.
ALL-UNION SCIENTIFIC MEETING ON RADIO DAY: CYBERNETICS, BIONICS AND ENGINEERING PSYCHOLOGY
9 Nov. 1973 119 p Transl. into ENGLISH of "Vsesoyuznaya Nauchnaya Sessiya, Posvyashchennaya Dnyu Radio: Sektsiya Kibernetiki, Sektsiya Bioniki i Inzhenernoy Psikhologii" Moscow.

1973
(JPRS-60503) Avail: NTIS HC $8.00
Summaries of reports are given on cybernetics, bionics, and engineering psychology delivered at the All-Union Scientific meeting. Author

N74-12687# Committee on Science and Astronautics (U. S. House).
THE FEDERAL GOVERNMENT AND ENERGY: R AND D HISTORICAL BACKGROUND
Washington GPO Mar. 1973 111 p refs Presented to Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 20 Mar. 1973 Prepared by Library of Congr.
Avail: Subcomm. on Energy
Energy source R and D is traced for the Navy, the National Bureau of Standards, Federal Power Commission, Tennessee Valley Authority, Atomic Energy Commission, National Science Foundation, National Aeronautics and Space Administration, and Advisory boards and committees. A historical look at aviation technology is given along with research in the Dept. of Interior including geological surveys for the Bureau of Mines, and Offices of Oil, Gas, and Coal. T.M.R.

N74-12688# Committee on Science and Astronautics (U. S. House).
AN INVENTORY OF ENERGY RESEARCH, VOLUME 1
Washington GPO Mar. 1972 1111 p refs Presented to Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 20 Feb. 1972 Prepared by ORNL for Task Force on Energy Sponsored by NSF 2 Vol.
Avail: Subcomm. on Sci., Res., and Develop.
An inventory of energy research was prepared for the subcommittee on science, research, and development of the U.S. House of Representatives. An overview of the research being conducted on most aspects of energy production and use is provided. The survey was prompted by the concern for the limitation in the sources of energy and the impact of the production and use of energy on the environment. Within fourteen categories of energy sources 4,400 research projects have been identified. Author

N74-12689# Committee on Science and Astronautics (U. S. House).
AN INVENTORY OF ENERGY RESEARCH, VOLUME 2
Washington GPO Mar. 1972 631 p refs Presented to Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 20 Feb. 1972 Prepared by ORNL for Task Force on Energy Sponsored by NSF 2 Vol.
Avail: Subcomm. on Sci., Res., and Develop.
A permuted index of research projects involving energy sources was prepared for the subcommittee on science, research, and development of the U.S. House of Representatives. The index identifies fourteen categories of energy sources and 4,400 research projects within the categories. Author

N74-12690# Committee on Science and Astronautics (U. S. House).
SHORT TERM ENERGY SHORTAGES
Washington GPO 1973 927 p refs Hearings before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 7, 3, 8, and 17 May 1973
Avail: Subcomm. on Energy
The hearings are reported concerning the causes and implications of the impending shortages of gasoline, heating oil, fuel oil, jet fuel, and electricity. Short term fuel shortages and their effects on electric utilities are analyzed. Other topics discussed include: natural gas supply, electric energy supply; R and D considerations, and convertibility of oil-fired electric utility plants to coal. F.O.S.

N74-12691# Committee on Science and Astronautics (U. S. House).
ENERGY RESEARCH AND DEVELOPMENT AND SPACE TECHNOLOGY
Washington GPO 1973 573 p refs Hearings before Subcomm. on Space Sci. and Appl. and Subcomm. on Energy of the Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 9, 7, 22, and 24 May 1973
Avail: Comm. on Sci. and Astronaut.
The hearings concerning the energy R and D for developing long-term fuel supplies are reported. Topics discussed include: role of the Federal Laboratories in energy R and D; energy crisis and consumer costs, university programs, nuclear energy, and the relay of energy from power satellites by microwave beams. F.O.S.

N74-12692# Joint Publications Research Service, Arlington, Va.
SCIENCE SUPPORT AND MANAGEMENT
G. M. Dobrov and G. M. Glagoleva 12 Nov. 1973 23 p refs Transl. into ENGLISH from Ekonomika i Organizatsiya Promyshlennogo Proizvodstva (Moscow), no. 3, 1973 p 14-30
(JPRS-60509) Avail: NTIS HC $3.25 CSCL 05A
Articles are presented on the systems approach to science management and on the material and technical support of science. Author

N74-12693# Joint Publications Research Service, Arlington, Va.
MATHEMATICAL METHODS OF OPTIMAL PLANNING DEVELOPMENT AND USE OF ENERGY SYSTEMS
L. P. Padalko 15 Nov. 1973 209 p refs Transl. into ENGLISH of the book "Matematicheskiye Metody Optimal'nogo Planirovaniya Razvitiya i Ekspluatatsii Energosistem" Minsk, Izdatel' stvo Vysheyshaya Shkola, 1973 199 p
(JPRS-60546) Avail: NTIS HC $12.50
A discussion is given of the bases of mathematical methods of optimal planning and their use for selecting optical solutions in the planning, development, and operation of power supply systems. Author

N74-12694# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE, SCIENTIFIC AFFAIRS, NO. 367
12 Nov. 1973 34 p refs Transl. into ENGLISH from Bulgarian and Polish articles
(JPRS-60507) Avail: NTIS HC $3.75
An article is reported concerning coordination and subordination systems of nature and society. A description is given of systems divided on the basis of the Marxist doctrine of the socioeconomic formation. Production relations, productive forces, and social relations are discussed along with conflicts in a coordination system. Also presented is an article on the development of RASKO-2, the first Polish designed rocket for cloud seeding. Rocket design and operation are described along with operating characteristics such as rapid firing, operational limits with regard to wind, and reliability. K.M.M.

N74-12695# Oak Ridge National Lab., Tenn.
ENERGY RESEARCH AND DEVELOPMENT: A SELECTED READING LIST
M. P. Guthrie, ed., E. E. Huber, ed., and G. A. Norwood, ed. (AEC, Washington, D. C.) Nov. 1973 107 p Revised
(Contract W-7405-eng-26; NSF-IA-AAA-R-479)
(ORNL-EIS-73-65-Rev-1) Avail: NTIS HC $7.50
A selected list of readings designed to aid policymakers in the identification of promising areas for energy research and development is presented. The document is also designed to assist the informed layman who wishes to orient himself in this overall field. The genesis of the reading list was a need to gain a perspective on what has already been done in energy research and development. This perspective was required to support the development of a report to the President from the Chairman of the Atomic Energy Commission on long-range energy research and development needs and policy as requested in the President's June 29, 1973, statement on Energy and National Resources. A basic aim was to include monographs and reports on technology assessment for each of the many energy technologies. The bibliography emphasizes general publications on energy sources, electric power, generation, and energy uses. Detailed technical reports and scientific papers are included only to a limited extent. A special effort was made to include Congressional publications relating to energy. Author

N74-12696# Los Alamos Scientific Lab., N.Mex.
SOME INTERFACES IN RESOURCE UTILIZATION
L. P. Reinig [1973] 16 p refs Presented at Symp. on Econ. Develop. vs. Environ. Quality in the Southwest, Lubbock, Tex., 19-20 Apr. 1973; sponsored by Comm. on Desert and Arid Zone Res. of the Am. Assoc. For the Advan. of Sci.
(Contract W-7405-eng-36)
(LA-UR-73-570; Conf-730440-1) Avail: NTIS HC $3.00

Los Alamos Scientific Laboratory is engaged in programs to explore the ways of extracting useful power from the heat of the earth's crust; to demonstrate the feasibility of superconducting transmission lines; and to develop a rock-melting penetrator, or subterrene, expected to be capable of creating long tunnels in rock. The tunnels, lined with the glass-like melted rock created by passage of the subterrene, might form excellent conduits for underground transmission lines, as well as serving in the exploitation of geothermal energy. A project to exploit the vast underground reservoir of saline water in New Mexico is described. The project TRG is based on desalination by means of geothermal or nuclear energy to furnish New Mexico with water and electric power. NSA

N74-12697# Oak Ridge National Lab., Tenn.
MATERIAL RESOURCES AND RECYCLING Progress Report, 1 Jan. 1971 - 15 Jun. 1972
Jul. 1973 136 p refs
(Contract W-7405-eng-26)
(ORNL-NSF-EP-42) Avail: NTIS HC $9.00

The activities of the Material Resources and Recycling (MRR) Team of the NSF-supported Environmental Program at Oak Ridge National Laboratory are described. One part of the work involves the assessment of materials management problems such as the long-term availability of nonfuel, nonrenewable resources; the energy expenditures for extracting metals from lower grade ores and for recycling; the land use conflicts associated with forest management; and the control of toxic metals, especially mercury and cadmium. A second part of the work includes laboratory experiments to investigate the movement of cadmium and mercury in aquatic and terrestrial ecosystems with some focus on the chemistry of these elements in the soil and sediment sinks. The third part of MRR activities involves waste management studies. Author (NSA)

N74-12698# Federal Railroad Administration Washington, D.C.
HIGH SPEED GROUND TRANSPORTATION ACT OF 1965 Annual Report
Sep. 1972 145 p refs
(PB-222261/0; FRA-ORD/D-74-8; AR-6) Avail: NTIS HC $4.50 CSCL 13F

The high speed ground transportation activities are discussed for the period ending 30 September 1972. Previous reports of the former office of High Speed Ground Transportation have served as a source book on the HSGT Program for Congressional Committees, other DOT organizations, prospective contractors, academicians, and others wanting to know about HSGT program content, accomplishments, or future direction. HSGT activities are now a portion of the work of the Office of Research, Development, and Demonstrations in the reorganized Federal Railroad Administration. GRA

N74-12699# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A SIMULATION STUDY OF THE FORCE MIX PROBLEM IN CLOSE AIR SUPPORT OPERATIONS M.S. Thesis
Dennis K. Leedom and Arnold R. Thomas Jun. 1973 216 p refs
(AD-766879; GSA/SM/73-11) Avail: NTIS CSCL 15/7

A computer program was designed and constructed which simulated the operation of a single combat aircraft squadron in a close air support situation. The simulation model was specifically designed to highlight differences in effectiveness, vulnerability, availability, and cost between two aircraft with two different degrees of avionics sophistication. A weather model included in the simulation was based upon an analysis of longterm climatological records compiled from hourly weather observations at Bitburg Air Base, Germany. A hypothetical example was used to demonstrate the utility of the simulation model. Specifically, two different types of aircraft were postulated and used in the close air support squadron. Results of this example showed that the increased costs of advanced avionic equipment can be justified on an attrition cost per target killed basis. Futhermore, the use of a mixed aircraft squadron was shown to result in higher target kill rates under certain conditions. Weather conditions were shown to have a significant effect on squadron performance with attrition costs rising during bad weather conditions. (Modified author abstract) GRA

N74-12700# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 27, NO. 2
James T. Lester and Victoria Hewitson 28 Feb. 1973 28 p
(AD-757369; ESN-27-2) Avail: NTIS CSCL 05/2

The monthly publication presents brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by disclosing interesting information well in advance of the usual scientific publications. The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist. Author (GRA)

N74-12701# Naval Aerospace Medical Research Lab., Pensacola, Fla.
ANNOTATED BIBLIOGRAPY OF REPORTS Supplement No. 5 Jul. 1972 - 30 Jun. 1972
Rita S. McAllister 30 Jun. 1973 30 p refs
(AD-766458) Avail: NTIS CSCL 06/19

Contents: Mechanisms underlying the behavior of the organs of equilibrium which result in motion sickness, functional reflex disturbances, and other unwanted side effects in navy personnel; Hyperbaric-hypobaric interactions as they relate to compressed air diving and aviation; Predicting motivational change and aeronautical adaptability among Navy and Marine Corps aviation trainees; Predicting fleet effectiveness of Navy and Marine Corps pilots and flight officers; Analysis of operational functions and unique characteristics of the naval flight officer; Investigation of pilot background factors in aviation accidents; Performance in non-human primates as influenced by low-frequency electromagnetic fields; Cockpit assignability codes and techniques for the presentation of anthropometric data. GRA